Thesis opportunities within the Soil Physics and Land Management (SLM) group

Version February 2024

GLOBAL SOCIETAL ISSUES & FUNDAMENTAL RESEARCH
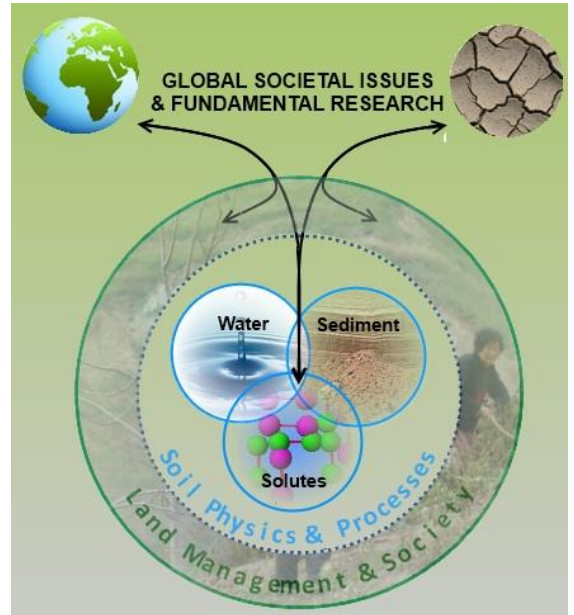
Dear students,

While you are on the search for thesis opportunities, you may use this booklet to get inspiration and ideas for your own MSc thesis research.

In the SLM chair group our research focuses on three domains, including **(1) soil physics** (flow and transport of water, heat, sediment and solutes), **(2) ecohydrology** (soil-water-plant interactions) and **(3) land use and management** (factors affecting soil degradation, conservation and restoration).

In this booklet you can find thesis opportunities which are currently available with our staff members and where you as a student can contribute to exciting projects! To make it easier to search for a topic, there is an overview in which all the topics are divided into the following classes: Water, Soil, Groundwater, Pollutants, Vegetation, Socioeconomic aspects. Also, feel free to approach us with your own research ideas!

When you would like to do your thesis within the SLM group, first contact one of our thesis coordinators to discuss your ideas and plans. MEE students should contact Loes van Schaik (loes.vanschaik@wur.nl), for MIL students the contact person is Michel Riksen (michel.riksen@wur.nl). And to join the SLM thesis rings, contact Loes van Schaik once you start with your thesis.

We are looking forward to collaborate with you!

WAGENINGEN
UNIVERSITY & RESEARCH

SLM staff involved in MSc thesis supervision

	Prof.dr. C. (Coen) Ritsema coen.ritsema@wur.nl	• Land Degradation • Soil Management • Soil Physics
	dr. ir. MJPM (Michel) Riksen michel.riksen@wur.nl	• MSc thesis coordinator (MIL students) • Wind erosion • Coastal dune management • Soil and water conservation • Rainwater harvesting
	Dr. NLMB (Loes) van Schaik loes.vanschaik@wur.nl	• MSc thesis coordinator (MEE students) • Ecohydrology • Soil physics
	Dr. ir. (Jantiene) Baartman jantiene.baartman@wur.nl	• Soil erosion modelling • Physical land degradation processes • Soil and water conservation
	JP (Joao) Carvalho Nunes PhD joao.carvalhonunes@wur.nl	• Hydrological process • Soil erosion • Water contamination • Socio-hydrological systems
	Dr. ir. JC (Jos) van Dam jos.vandam@wur.nl	• Ecohydrology • Physical soil transport processes • Modelling
	Dr. C. Stoof cathelijne.stoof@wur.nl	• Land degradation • Pyrogeography • Soil management

SLM staff involved in MSc thesis supervision

ing. G (George)Bier george.bier@wur.nl	- Hydrology - Groundwater - Modelling - Solute transport
dr. ir. K (Klaas) Metselaar klaas.metselaar@wur.nl	- Ecohydrology - Green roofs
prof. dr. V (Violette) Geissen violette.geissen@wur.nl	- Soil chemistry - Pesticide residues - Ecotoxicology - Soil biology
P (Paula) Harkes PhD paula.harkes@wur.nl	- Soil microbiology - Soil biology - Nematology
dr. X (Xiaomei) Yang xiaomei.yang@wur.nl	- Soil chemistry - Environmental analysis - Soil pollution - Soil quality
dr. E (Esperanza) Huerta Lwanga Esperanza.huertalwanga@wur.nl	- Hydrological process - Soil erosion - Water contamination - Socio-hydrological systems
dr. Reynold Chow Reynold.chow@wur.nl	- Hydrological process - Groundwater flow - Water contamination - Modelling

SLM staff involved in MSc thesis supervision

dr. ir. CA (Aad) Kessler aad.kessler@wur.nl	• Farmer decision-making & adoption • Intervention strategies • Integrated Farm Management
dr. ir. L (Luuk) Fleskens luuk.fleskens@wur.nl	• Ecosystem services • Multi-scale impact assessments SLM • Scenario analysis • Farmer decision-making
dr. S (Saskia) van der Kooij saskia.vanderkooij@wur.nl	• Water management • Resource efficiency • Circular economy
TA (Teun) Vogel MSc teun.vogel@wur.nl	• Land restoration • GIS , drones
dr. K. (Karrar) Mahdi Karrar.mahdi@wur.nl	• Soil-landscape degradation • Climate smart agriculture
dr. V (Vera) Felix da Graca Silva Vera.felixdagracasilva@wur.nl	• Soil pollution • Pesticide transport • Risk assessment
dr. M. (Mahrooz) Rezaei Mahrooz.Rezaei@wur.nl	• Soil erosion • Wind erosion • Microplastic transport in wind erosion
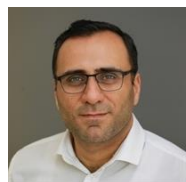
#	Water	Supervisor
1	Quantifying burrowing animals' impact on soil hydro-physical dynamics	Jantiene Baartman
2	Ecohydrology of Tenerife	Klaas Metselaar
3	Ecohydrology of Texel	Klaas Metselaar
4	Effect organic amendments and earthworms on soil hydrology	Loes van Schaik
5	Sustainable rainwater management on the Dutch Caribbean	Michel Riksen, Klaas Metselaar, Jantiene Baartman
6	Optimizing irrigation for maize yield and soil carbon storage in the Mediterranean	Luuk Fleskens
7	Rainfall simulation sprinkler system: installation and calibration	Xiaomei Yang
8	Evaluating landscape measures to mitigate floods and droughts-LandEX project	Jantiene Baartman
9	Dynamic soil hydrological modelling using a high-resolution lysimeter in southern Chile	Loes van Schaik, Jos van Dam
10	Exploring the effects of mulch on soil water processes: laboratory, field and modelling	Joao Nunes, Karrar Mahdi
11	Evaluating managed aquifer recharge schemes in the cape flats aquifer, South Africa	Reynold Chow
12	Vegetation responses to groundwater depletion in semi-arid coastal sand dunes	Loes van Schaik, Joao Nunes
13	Water retention in higher sandy regions of the Netherlands	George Bier
14	Evaluating restoration measures of the Beekbergerwoud	George Bier/ Klaas Metselaar

#	Soil	Supervisor
1	Soil monitoring in a regenerative organic farm, Spain	Michel Riksen, Loes van Schaik
2	Soil health in Norway	Loes van Schaik
3	Impacts of global change on soil health and ecosystem services in Mediterranean environments	Jantiene Baartman
4	Soil compaction research in the Netherlands	Jos van Dam, Loes van Schaik
5	Assessing erosion in Mediterranean orchards under different management	Joao Nunes
6	Soil at regenerative apple cider orchard	Michel Riksen
7	Agroecological soil management in chestnut agroecosystems: impacts on soil quality	Jantiene Baartman
8	Soil carbon storage in successional agroforestry systems	Luuk Fleskens
9	The effect of management practices on soil functions	Luuk Fleskens
10	Snowmelt, soil erosion and NBS in Norway	Jantiene Baartman
11	Sediment and nutrient dynamics in agroforested catchments in NW Iberian Peninsula	Joao Nunes
12	Soil degradation by fire and erosion & soil conservation through mulch and biochar	Jantiene Baartman, Joao Nunes

| #		Supervisor
13	Wildfire effect on soil erosion and plant recovery and post-fire conservation	Jantiene Baartman
14	Estimating PM10 dust emissions using the PI-SWERL	Mahrooz Rezaei, Dirk Goossens
15	Emerging crops in sustainable agriculture	Klaas Metselaar

#	Pollutants	Supervisor
1	Modelling the atmospheric transport and deposition of microplastics in Portugal	Mahrooz Rezaei
2	How MicroPlastics affect soil structure and their transport with runoff and erosion	Jantiene Baartman, Loes van Schaik
3	Abiotic transport of pesticides along microplastic-contaminated soil profiles	Xiaomei Yang
4	Microplastic fragmentation and effects on soil quality	Xiaomei Yang
5	Microplastic transport behaviour with earthworms in soil profile	Xiaomei Yang
6	Assessing the vertical transport and fate of microplastics in soil	Xiaomei Yang
7	Modeling leaching potential of Veterinary Pharmaceuticals in Chile	Nikola Rakonjac
8	Characterization of large-scale diffuse nutrient pollution sources	Joao Nunes
9	Evaluating urban sources of aquatic pesticide pollution and the risk of pesticide pollution mixtures in western cape rivers, South Africa	Reynold Chow
10	Developing risk maps of aquatic pesticide pollution in rivers of the Czech Republic based on agricultural application patterns	Reynold Chow
11	Mapping PFAS groundwater vulnerability in South Africa	Reynold Chow
12	PESTICIDE PLANET: research, political and societal challenges	Vera Felix da Graca Silva

#	Socio-economic analysis	Supervisor
1	Transformations and adaptations in African farming systems	Luuk Fleskens
2	Making Lasting Impact: Unravelling Customers'/Farmers' Preferences to Derive Viable Business Models for the Sustainable Scaling of Rainwater Harvesting in Jordan	Karrar Mahdi
3	Bridging the digital divide: supporting the information needs of smallholder farmers	Luuk Fleskens
4	MIL thesis opportunities on SLM and PIP-related topics in Uganda	Aad Kessler
5	MIL thesis opportunities on SLM and PIP-related topics in Burundi	Aad Kessler

WAGENINGEN
UNIVERSITY & RESEARCH

Quantifying burrowing animals' impact on soil hydro-physical dynamics

Country: Netherlands
Host institute:
Online possible ? Yes
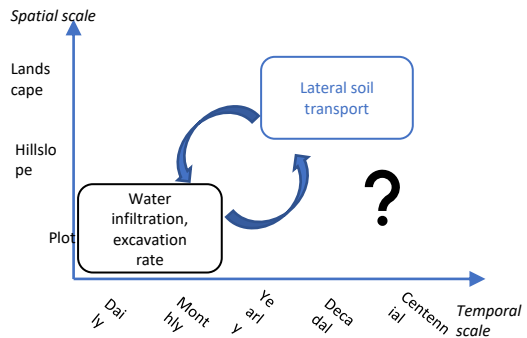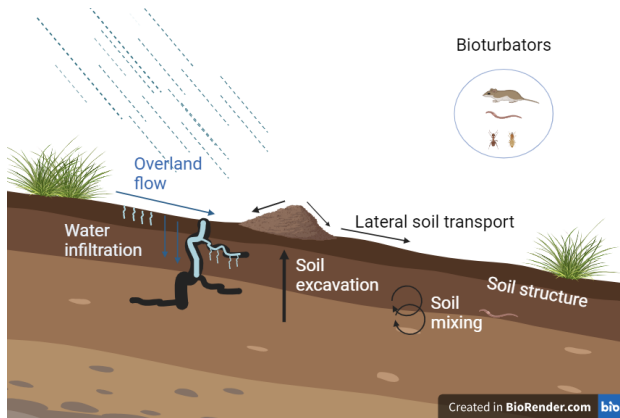
Project description

The presence of burrowing animals is a recognizable characteristic in almost all types of landscapes and climates. Independent of their size, their activity of mounding and digging plays a significant role in landscape evolution, to the point of being addressed as ecosystem engineers. For example, while tunnels facilitate water infiltration, mounds slow down surface runoff and make soil available for erosion. Several models have included animal activity as a bioturbation process, and many studies have quantified the impact of animals' presence on soil properties. However, how to best include burrowing animals' role in other soil hydro-physical processes in hydrological, landscape evolution, or soil erosion models is still unclear. Indeed, the significant heterogeneity of animals' distribution and their impact at different spatio-temporal scales complicates their inclusion into models. As such, the purpose of our research is to examine the impact of small burrowing terrestrial animals on soil movement and hydrological properties by running rainfall simulation experiments. We will then use the information collected to develop a bio-hydro-landscape module and add it to Landlab, a Python-based modeling environment used to design numerical landscape models.

Research objectives / potential thesis topics:
- Quantify the role that animal bioturbators have on soil hydro-physical processes at different spatio-temporal scales running rainfall simulation experiments
- Develop a bio-hydro-landscape evolution module

What is expected from the student?
Have some basic knowledge in soil hydro-physical processes and modeling. Depending on the starting date, the student will be able to either join the rainfall simulation experiment or the modeling part.

Project details

Group: Soil Physics and Land Management group

Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: April/May 2024 (flexible)
End date:

Used skills: data collection, data analysis, modeling
Requirements:

Contact

Supervisor(s): Marta Loreggian (SLM, SGL), Jantiene Baartman (SLM), Annegret Larsen (SGL)
Examiner: Coen Ritsema
Contact details: marta.loreggian@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Ecohydrology of Tenerife

Country: Spain

Host institute: WUR

Online possible ? : no

Project description

This is a project consisting of multiple topics from which you can pick and choose. The project is focused on modelling rainwater dependent vegetation on different scales. You can either construct a model yourself, or use and apply an existing model. The scales you can study and analyze are field, transect, or larger scales, e.g. specific vegetation zones. The largest scale that of the island including land use aspects can only be addressed by very clever simplification, and will result in approximations only. You may include the effects of climate change, changes in land use. The research will be further detailed according to your interest.

Project details

Group: Soil Physics and Land Management group

Project type: Thesis
Study programme: MEE
Begin date: september 2024
End date: end winter 2025
Requirements: (interest in modeling and vegetation-water -soil interaciotn)

Contact

Supervisor(s): Klaas Metselaar
Examiner: tbd
Contact details: klaas.metselaar@wur.nl

Ecohydrology of Texel
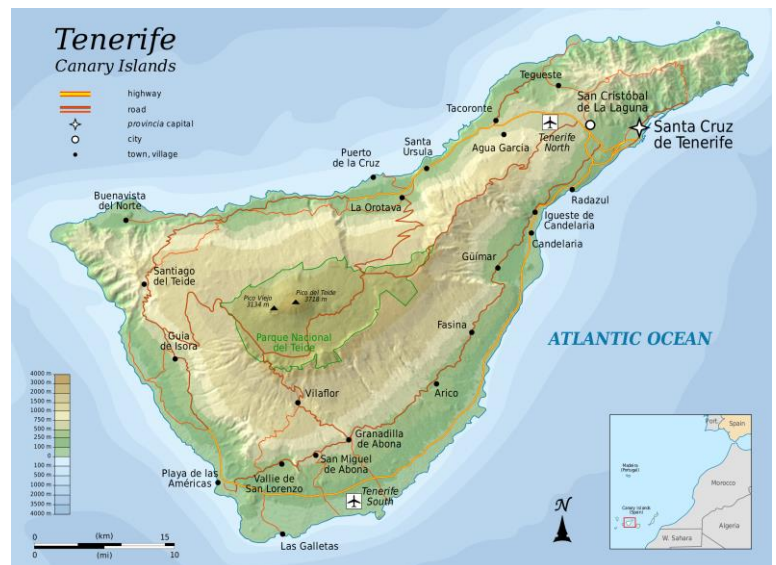
Country: Netherlands

Host institute: WUR

Online possible ? : no

Project description

This is a project consisting of multiple topics from which you can pick and choose. The project is focused on modelling groundwater dependent vegetation on different scales. You can either construct a model yourself, or use and apply an existing model. The scales you can study and analyze are field, transect, polder, or larger scales. The largest scale that of the island can only be addressed by very clever simplification, and will result in approximations only. You may include the effects of climate change, changes in water management, and salinity. The research will be further detailed according to your interest.
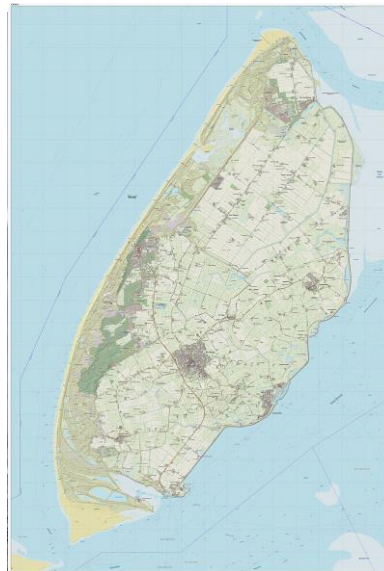
Project details

Group: Soil Physics and Land Management group

Project type: Thesis
Study programme: MEE
Begin date: september 2024
End date: end winter 2025
Requirements: (interest in modeling and vegetation-water -soil interaciotn)

Contact
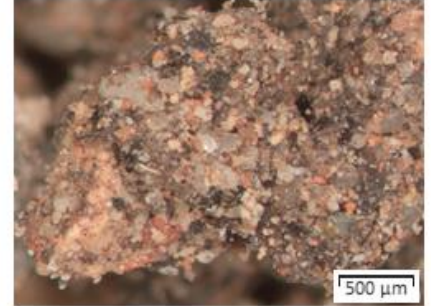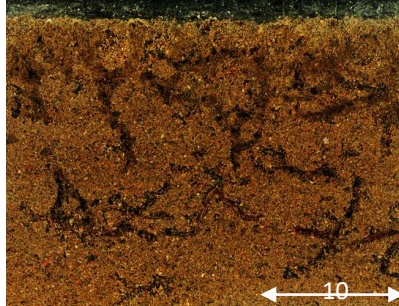
Supervisor(s): Klaas Metselaar
Examiner: tbd
Contact details: klaas.metselaar@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Organic amendments and earthworm activity to improve soil hydrology

Country:

Host institute: WUR, Soil physics and land management and Soil Biology

Project description

Climate change leads to more frequent drought and high intensity rainfall events. In recent years, arable production suffered from both, with droughts being particularly impactful on sandy soils. Innovations are needed to prevent freshwater reserves from being depleted and crop production from being water-limited. Against this background we wish to design measures to improve infiltration and soil water retention through selective amendment of organic matter that promotes soil water retention. However, we do not know which quality of organic matter is particularly effective in promoting soil water retention.

In this thesis study, you will design an experimental set-up to test several types of organic matter on their capacity to improve soil water retention. On the long run, we would like to link this capacity to chemical characteristics of organic amendments, such that we are better able to advise farmers on organic matter management with the purpose to mitigate the impact of droughts and heavy showers.

Project details

Group: Soil Physics and Land Management & Soil Biology
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:

Contact

Supervisor(s): Loes van Schaik, Ellis Hoffland
Examiner: t.b.d.
Contact details: loes.vanschaik@wur.nl, Ellis.hoffland@wur.nl
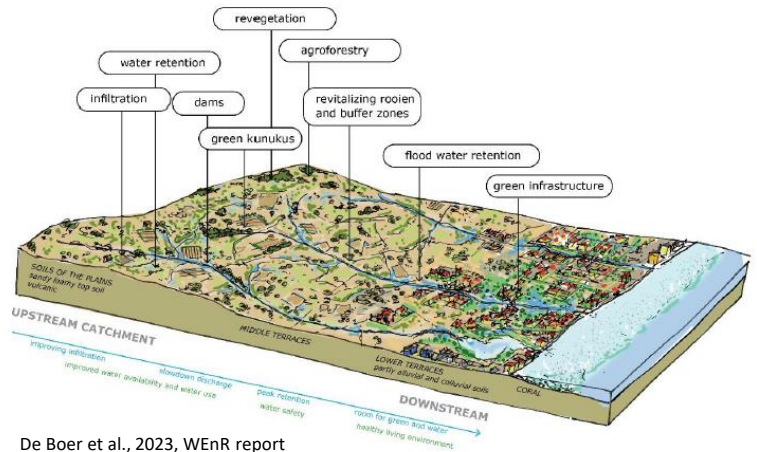
WAGENINGEN
UNIVERSITY & RESEARCH

Sustainable rainwater management on the Dutch Caribbean

Country: Bonaire, St. Eustatius and Saba

Host institute: t.b.d.

Online possible: depending on topic

NOS 9 Nov 2022; STINAPA / Caspar

De Boer et al., 2023, WEnR report 3292

Project description

On Bonaire, Saba and St. Eustatius, intensive rain showers lead to rainwater runoff, resulting in uncontrolled flooding, especially in the build-up areas, and soil erosion and deposition, which causes nuisance, damage, and impacts the coral reef. The freshwater balance of the islands is hardly known, while rainwater on Saba and Sint Eustatius is an important source of irrigation and sometimes still drinking water. On Bonaire, the freshwater supply in the groundwater is unknown - it is known to be brackish, but getting and keeping an overview is difficult due to the geology of the island (karst). The small areas of open fresh water are of great importance to the local fauna, especially birds and migratory birds. Better management of rainwater therefore serves two purposes: preventing nuisance caused by runoff and sediment transport, and contributing to the fresh water supply on these islands, for humans (limited) and animals (essential).

Research Objective/Question
In order to achieve sustainable rainwater management for various catchments, insight is required into:
1. Rainwater runoff: which areas contribute most to surface runoff and where do we see water concentrations occurring?
2. Quantifying erosion and sediment: sources and sediment transport towards the coast through modelling (e.g. LISEM)
3. What rainwater management structures already exist on the islands, both in urban areas and in the countryside: What kind of measures are there and how do they function?
4. The stakeholders in the problem areas: which parties influence water management and who are experiencing nuisance or lack of water? What plans have been made that could possibly influence rainwater discharge?
5. Potential technical and policy measures for sustainable water management on the islands.

What is expected from the student (type of research)
Depending on the exact research topic, various activities will be carried out, ranging from field measurements of runoff, infiltration and other biophysical parameters, modelling and/or GIS analysis, mapping and analysing existing structure and interviews and stakeholder analysis.

Project details
Group: Soil Physics and Land Management group

Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: fieldwork, GIS analysis, mapping, measuring, modelling, interviewing
Requirements: t.b.d.

Contact
Supervisor(s): Michel Riksen, Klaas Metselaar, Jantiene Baartman (WUR), Sander Mucher (WENR)
Examiner: Coen Ritsema
Contact details: michel.risken@wur.nl, klaas.metselaar@wur.nl or jantiene.baartman@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Optimizing irrigation for maize yield and soil carbon storage in the Mediterranean

Country: Portugal

Host institute: Polytechnic of Coimbra, Coimbra Agriculture School

Online possible: No

Project description

Problem context:

Rising temperatures and unpredictable precipitation patterns due to climate change will strongly impact the Mediterranean region. Water scarcity poses a significant threat to agricultural productivity, where optimizing irrigation practices is crucial for sustainable food production. As a hot-spot for climate change impacts, more research is needed to mitigate water stress while maintaining agricultural resilience in the Mediterranean region.

Research objective:

This research aims to assess the effects of different drip irrigation treatments on maize yield and soil carbon dynamics in the Mediterranean context. Three different amounts of irrigation with two different application timings will be tested to identify optimal irrigation practices for sustainable agriculture. The experiment will be conducted in a field belonging to Coimbra Agriculture School, in the central region of Portugal.

What is expected from the student (type of research):

The research will involve a combination of fieldwork (soil sampling and irrigation) and laboratory analysis to quantify soil carbon dynamics. Students will gain practical experience in fieldwork, soil science, carbon sequestration assessments, and data analysis.

Project details

Group: Soil Physics and Land Management group

Project type: Thesis / Internship
Study programme: MIL & MEE

Begin date: flexible

Used skills: fieldwork, lab analyses, potentially modelling
Requirements: Fundamentals of Land Management
(SLM31306)

Contact

Supervisor(s): Luuk Fleskens and Pedro Soares
Examiner: tbc
Contact details: luuk.fleskens@wur.nl
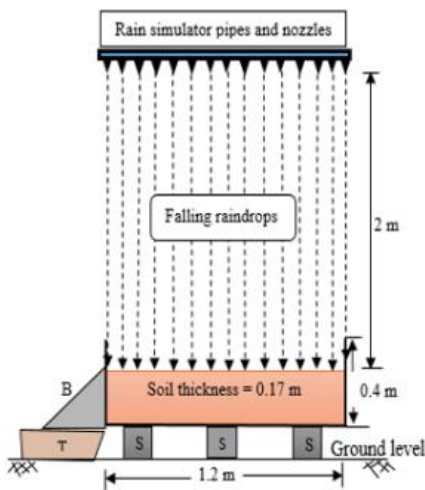
WAGENINGEN
UNIVERSITY & RESEARCH

Rainfall simulation sprinkler system: installation and calibration

Country: Greece

Host institute: Hellenic Mediterranean University

Online possible ? :no

Project description

This project is about the new design of rainfall simulation sprinkler system, as well as its function to simulate rainfall intensity and erosion issues. The main tasks are: 1) to install the completion of the rainfall simulation sprinkler system (currently 75% completed and the initial design is available on paper); 2) to calibrate the system (i.e., measure actual water heights in the bed under various flow rates for different sprinkler types) 3) to calibrate existing flow rate measurement system (tipping bucket); 4) to measure and model rainfall-runoff for different flow rates (precipitation intensities) and bed slopes.

What we expect from you: 1) a functioning rainfall simulation system (within the limitations of the infrastructure already available); 2) a functioning rainfall-runoff model for the simulator (opensource) ; 3) a report documenting (a) simulator specifications, design and building process, (b) calibration process, and (c) modeling approach and results.

With the tasks mentioned above, we are looking for students who can partly take one of the tasks as your internship or can be involved the whole tasks to do your thesis under supervision of the group from Department of Agriculture, School of Agricultural Science, Hellenic Mediterranean University. Most important skills required for this project are modeling and programming. Feel free to contact us about the skill requirement. And once you are enrolled, we will help you to write your internship/thesis proposal.

Project details

Group: Soil Physics and Land Management group

Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: Flexible
End date: Flexible

Used skills: Modeling and programming
Requirements: to be discussed.

Contact

Supervisor(s): Ioannis Daliakopoulos/Xiaomei Yang
Examiner:
Contact details: idaliak@hmu.gr; xiaomei.yang@wur.nl
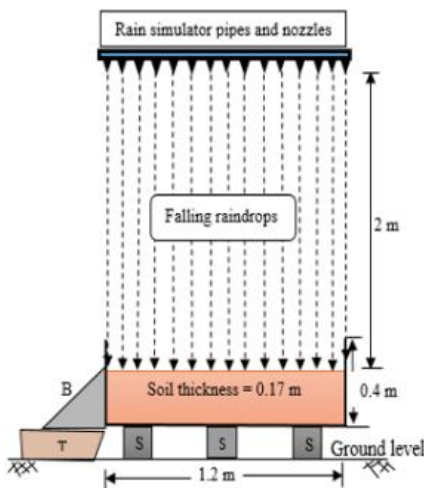
WAGENINGEN
UNIVERSITY & RESEARCH

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Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: Flexible
End date: Flexible

Used skills: Modeling and programming
Requirements: to be discussed.

Contact

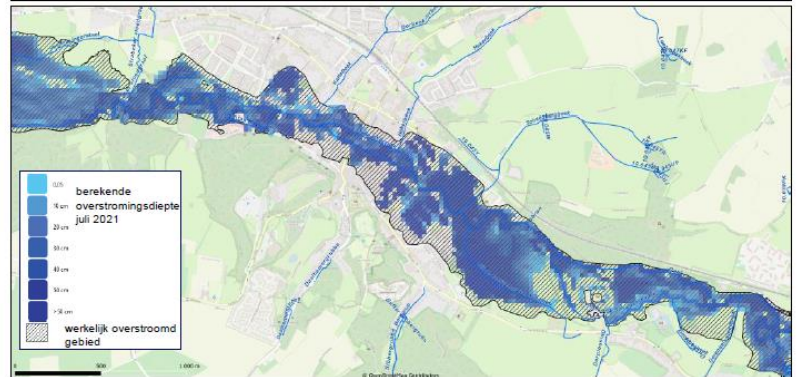Supervisor(s): Ioannis Daliakopoulos/Xiaomei Yang
Examiner:
Contact details: idaliak@hmu.gr; xiaomei.yang@wur.nl

Evaluating landscape measures to mitigate floods and droughts – LandEX project

Country: NL (or potentially partner countries: Portugal, Spain, Norway, Sweden)
Host institute: t.b.d.

Calculated flood areas of the Geul river near Valkenburg. The striped areas are the really flooded areas based on aerial imagery, blue colours indicate water depths based on model calculations.
Source: Deltares, 2022. Analyse overstroming Valkenburg. Watersysteemevaluatie Waterschap Limburg

Project description

Floods and droughts have become an increasing societal concern. The LandEX project aims to improve landscape resilience to floods and droughts by spatially optimising a suite of adaptation measures in the landscape. Questions addressed include: (i) how can various (Nature-Based) measures increase water retention in the landscape; (ii) how do their spatial location determine their effectiveness at the landscape level, and (iii) what are the potential synergies in a network of measures distributed throughout the landscape? LandEX will design spatially-explicit adaptation scenarios in close collaboration with local stakeholders and quantify their effectiveness using connectivity-based spatially distributed hydrological modelling in 5 study areas in northern and southern Europe.

Research Objectives/Questions
Depending on the student's interested and stage of the project, potential topics are:
- Analysis of flood and drought hotspots and existing measures
- Synergy of flood and drought measures and their functioning in the landscape
- Connectivity-based modelling of flood and drought risks
- Co-design of spatial (Nature Based Solutions) effective measures in collaboration with local stakeholders
- Process-based modelling of the effectiveness of the designed measures

What is expected from the student (type of research)
Depending on the exact research topic, various activities will be carried out. Spatial modelling (e.g. using OpenLISEM and connectivity analysis), field measurements, mapping and analysing of existing measures and interviews and stakeholder analysis regarding their preferred measures.

Project details
Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: tbd, likely from September 2024 onwards
End date: tbd

Used skills: modelling, interviewing, fieldwork, mapping, measuring
Requirements: depending on topic (e.g.: modelling)

Contact
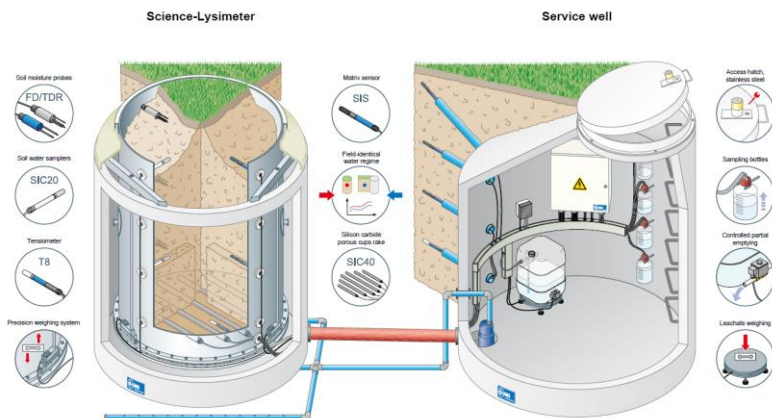Supervisor(s): Meindert Commelin, Jantiene Baartman, Joao Nunes
Examiner: Coen Ritsema
Contact details: jantiene.baartman@wur.nl

Dynamic soil hydrological modelling using a high-resolution lysimeter in southern Chile

Country: The Netherlands
Host institute: Wageningen University – Soil Physics and Land Management Group

Valdivia, Chile

Project description

In southern Chile, volcanic ash-derived soils sustain around 60% of the country's agriculture. In this humid-temperate climate, extreme soil physical and hydrological properties play a crucial role in water storage, particularly when facing a 100 mm/decade rainfall decline since 1960. Accurate water balance calculations and hydrological projections are essential not only to face potential climate change impacts on food security but also to unravel the soil physical degradation due to hydraulic stress. Spatiotemporal variability of soil hydraulic properties and the resulting non-uniform water flows constrain our capacity to accurately predict soil water distribution. Despite advances in hydrological models, the estimation of the required hydraulic parameters still overlooks the temporal dynamics of soil physical and hydraulic properties.

Research objective

This research project aims to improve the performance of soil hydrological models by assessing the temporal variability of hydraulic parameter estimation based on soil structure and water dynamics using high-resolution lysimeter data. To achieve this, we proposed the following objectives:

1) Quantify effective precipitation and actual evapotranspiration using high-resolution weighable lysimeter measurements.
2) Integrate data on effective precipitation, actual evapotranspiration, and soil water dynamics to characterize soil structure and water dynamics.
3) Employ dynamic-based soil hydraulic parameter estimation alongside high-precision lysimeter data to enhance the accuracy of hydrological models.

Project details

Group: Soil Physics and Land Management (SLM)
Project type: MSc thesis
Study programme: MEE / MIL

Begin date: September 2024 onwards, any period.
End date: tbd

Used skills: literature review, data analysis and time series, modelling, and scientific writing.
Requirements: statistical analysis, basic programming (preferably R but not exclusive; data manipulation, plotting, loops and conditionals), modelling in HYDRUS-1D/SWAP

Contact

Supervisor(s): Loes van Schaik, Sebastián Bravo-Peña (WUR) / José Dörner (Universidad Austral de Chile, Chile)

Examiner: tbd

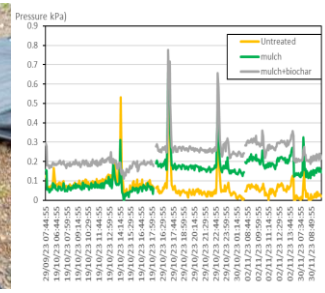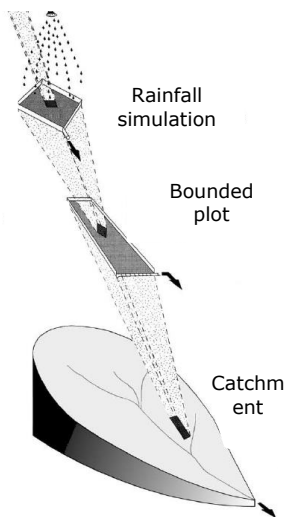Contact details: loes.vanschaik@wur.nl, sebastian.bravopena@wur.nl

Exploring the effects of mulch on soil water processes: laboratory, field and modelling

Country: Portugal

Host institute: MED, University of Evora

Project description

Problem context

The spreading of a layer of organic material over the soil surface, "mulching", has been widely recognized as an effective soil and water conservation technique. However, the study of the hydrologic and erosive processes poses many challenges, since they are highly dependent on the spatial and temporal scales, as well as a broad number of topographic, climate, soil and biological field variables. Researchers must carry out complex and intensive field assessments with enough replications to avoid mixed, coupled or inconsistent results. Alternatively, rainfall simulations offer a reliable alternative to compare scenarios under controlled conditions.

Research Objective: The main aim of the work is to improve the knowledge on the effects of mulch on the hydrologic processes through a laboratory, field and modelling approach. The specific objectives can be one of the following:

1. Calibrate and assess the artificial rainfall characteristics in an indoor set-up (drop size, rainfall distribution, intensity and amount);

2. Calibrate and assess water level pressure sensors in an indoor set-up (water discharge, V-notch configuration under different flow rates and peak flows);

3. Calculate the hydrologic response from different soil treatments (untreated, mulch, mulch+biochar) from "Montado", vineyards and/or olive orchards of three ongoing U. Evora research projects (SOLVO, SOLVIT, BIOMONTADO; https://www.med.uevora.pt/).

4. Predict the performance of mulch-based treatments and their effectiveness at broad temporal and spatial scales through hydrologic modelling (LISEM, SWAT, etc).

Expected research methods: The workplan involves a mixed laboratory, field and modelling approach, in which the students, after selection of a topic, will integrate the MED research team, which is focused in the: i) identification of the main effects of mulch on hydrology using rainfall simulations; ii) calibration of hydrologic monitoring devices (soil moisture sensors, pressure sensors, V-notchs, parshalls small flumes); iii) assessment of water discharge and peak flows in field plots; iv) prediction of the performance of mulch-based treatments trough hydrological modelling.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL / MEE / MIL & MEE

Begin and end date: to be determined

Used skills: Soil engineering, field work experimental set up
Requirements: soil sciences

Contact

WUR Supervisor: Joao Nunes / Karrar Mahdi
Host Supervisor: Sergio A. Prats/ José Munoz-Rojas
Contact details: joao.carvalhonunes@wur.nl
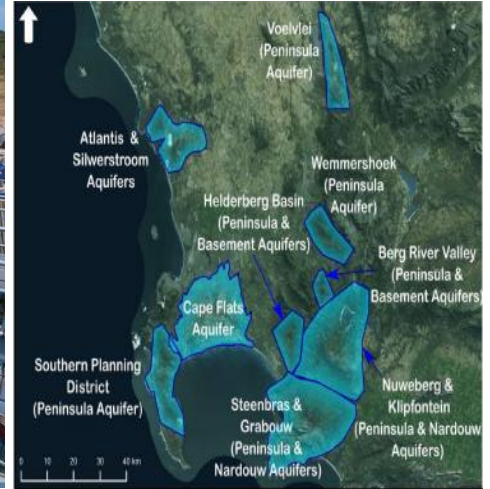
WAGENINGEN
UNIVERSITY & RESEARCH

Evaluating Managed Aquifer Recharge Schemes in the Cape Flats Aquifer, South Africa

Country: South Africa
Host institute: Soil Physics and Land Management (WUR) and Earth Sciences (Stellenbosch University)

(IOL, 2023)

(Water Outlook, 2018)

Project description

The Cape Flats Aquifer, located in the Western Cape, South Africa, has the potential of supplying considerable quantities of groundwater to the city of Cape Town and the surrounding municipalities. This groundwater resource will become increasingly important during droughts, such as the prolonged drought from 2015-2018 in the Western Cape.

South Africa's Department of Water and Sanitation (DWS) is planning to operate a managed aquifer recharge (MAR) scheme within the Cape Flats Aquifer to enhance its replenishment and to maintain a sustainable supply of groundwater.

To gain a better understanding of how managed aquifer recharge should be implemented, a 3D regional scale numerical groundwater model was developed in MODFLOW. This project aims to utilize the Cape Flats groundwater model to develop an optimal MAR scheme under different land use and climate change scenarios. The ideal MAR scheme will be able to sustainably supply groundwater to the region under a wide variety of conditions. The optimal MAR scheme will then be presented to the DWS to aid them in their MAR designs.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Hydrogeology, Groundwater Modelling

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl

Vegetation responses to groundwater depletion in semi-arid coastal sand dunes

Country: Portugal

Host institute: University of Lisbon (Faculty of Sciences)

Project description

Groundwater levels can greatly impact GW-dependent ecosystem water budgets and plant growth. Thus, changes to GW levels raise concerns in regions with a pronounced dry season and experiencing high water extraction for irrigation and public supply. This is the case of the stabilized coastal dunes of semi-arid Iberian Peninsula. Plant species living in these ecosystems depend on the ability to use the available water; different species might use GW from different soil layers, and change their main water-sources as GW table lowers.

This study will help to better understand water-resources use and GW dependency in these coastal plant communities. Potential research questions might include:

• Which are the main water sources used by woody plant species during the dry season? Does coexisting plants segregate along water-source-use? How is water-uptake depth affected by water-table depletion?
• Which are the physiological traits that change due to water-table lowering? How is their ecophysiological performance and vitality affected by water table depth? Do responses differ among plant functional types?

The research will consist of field sampling at semi-arid coastal dune systems in southwest of Portugal, along a water table gradient. Parameters to be sampled depend on the workplan, and can include:

• xylem, rain and groundwater composition (oxygen isotopes, analysed in the lab)
• soil properties, e.g. soil moisture, OM, nutrients…
• plant traits, e.g. leaf properties, water potential, NDVI...

Data will be assessed using statistical analysis and eventually geographical analysis using GIS.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: fieldwork, data analysis according to topic
Requirements: none in particular

Contact

Supervisors: Loes van Schaik or Joao Nunes
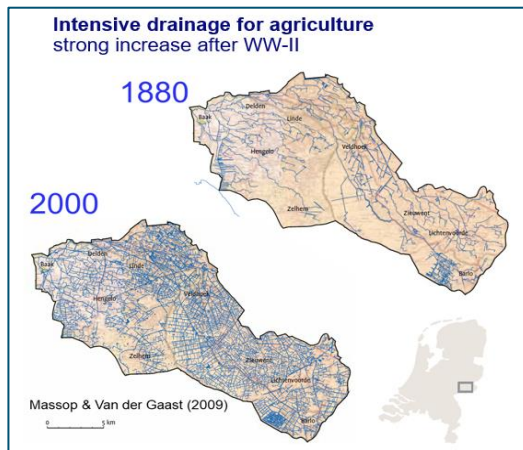Host supervisor: Cristina Antunes
Examiner: tbd
Contact details: joao.carvalhonunes@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Analysis of Water Retention potential at Higher Sandy Regions in the Netherlands by redesign of drainage network

Country: Netherlands

Host institute: Wageningen University

Intensive drainage for agriculture
strong increase after WW-II
1880
2000
Massop & Van der Gaast (2009)

Introduction

The higher sandy regions are increasingly confronted with drought in agriculture and nature, due to discrepancy between precipitation and evapotranspiration demand, and interventions in the past to remove excess water preventing flooding, use of groundwater for drinking, industry and agriculture and reduced groundwater recharge due to land use changes (e.g., pine forests planting). Sandy regions with a mosaic of intertwined functions with conflicting water requirements (mainly nature, agriculture, drinking water companies) oppose to optimize for all functions.

Objective/research question

How can measures in the drainage network of ditches and watercourses improve water retention in higher sandy regions? What is the contribution of measures in the tertiary (small ditches along agricultural fields) compared to measures in the secondary and primary drainage network (watercourses managed by water boards).

Approach

- Familiarize with the current available regional models (I-MOD)
- Set up catchment-scale models to analyze (1) the groundwater drainage process in time and space and (2) effects of different measures in the drainage system on water retention, groundwater levels and catchment discharge.
- Translate effects on groundwater levels to consequences for agriculture and nature using the Waterwijzers Landbouw and Natuur.
- Optimize the catchment drainage network to fulfill as good as possible the different requirements of agriculture and nature in the catchment.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time

Used skills:
Requirements:

Contact

Supervisor(s): George Bier / Perry de Louw
Examiner:
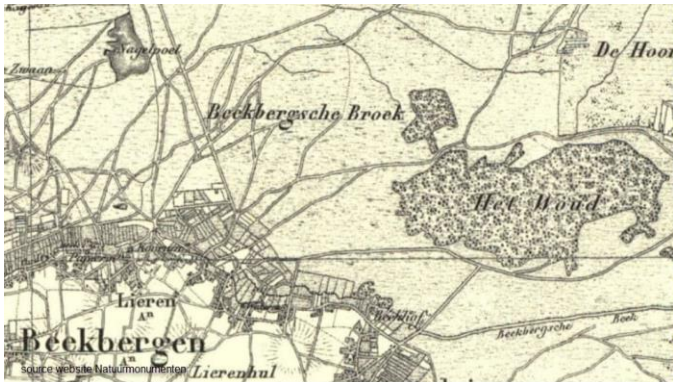Contact details: george.bier@wur.nl

Evaluating sustainability of restoration measures of the Beekbergerwoud

Country: Netherlands

Online possible: No

Project description

The Beekbergerwoud is considered to be the last primeval forest of the Netherlands before it was deforested and turned into grasslands in 1780. Natuurmonuments (owner) started restoration measures (affecting local water management and elevations) in 2006 to turn this area back into its original state.

Research question:
Are the undertaken restoration measures sufficient to have a resilient natural forest at this location?

Approach:
Use and analysis of various documents and data, setting up a regional groundwater model with MODFLOW including UZF simulating the unsaturated zone flow.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE
Begin and end date: to be decided with the student
Used skills: can include fieldwork and modelling
Requirements: SLM33306 Advanced Hydrological Systems Analysis

Contact

Supervisor(s): Klaas Metselaar / George Bier
Examiner: Klaas Metselaar / George Bier
Contact details: klaas.metselaar@wur.nl george.bier@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Soil monitoring in a regenerative organic farm, Spain

Country: Spain

Host institute: Regeneration Academy

Online possible ? : No

Project description

• Are you passionate about regenerative farming and eager to dive deep into the intricacies of soil, and how different practices affect it? And would you like to live on a regenerative organic farm in the south of Spain?

• Join the research program at the regeneration academy! We collaborate with two regenerative farms in the South of Spain, La Junquera (7 years under regenerative agriculture) and Finca el Roble (just converted to regenerative agriculture).

• What can you do?:

  — Help us out with the creation of a soil monitoring plan.

    • What are the main parameters and indicators needed?

    • Which tools and resources do we need?

  — Compare different regenerative practices on farm (no-till, reduced tillage, conventional tillage // use of swales// cover crops// etc) .

    • Compare moisture, carbon & soil life.

• Help us in general with soil monitoring

  — Taking soil samples, comparing fields, creating a soil map, where is erosion happening on the farms?, are there differences between crops?, where is the most macro-biodiversity?, can you compare the fields with GIS methods?.

• Join our Research Program at La Junquera and be a part of shaping the future of regenerative farming. During this program you will also get the opportunity to learn about how we manage the farm and help us out. Apply now to take on this exciting research opportunity!

Project details

Group: Soil Physics and Land Management group
Project type: Internship
Study programme: MIL / MEE / MIL & MEE

Begin date: March or September
End date: June or December

Used skills: Carry on you own research , GIS?
Requirements: Research material from WUR (Humidity sensors, other)

Contact

Supervisor(s): You need to find a supervisor at WUR, Clara Bosch will supervise from the Regeneration Academy.

Examiner: To be found at WUR

Contact details: email:Clara@regeneration-academy.org
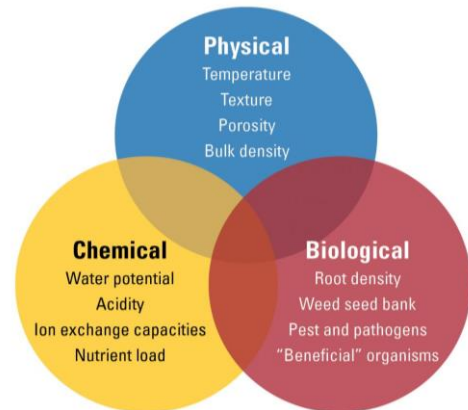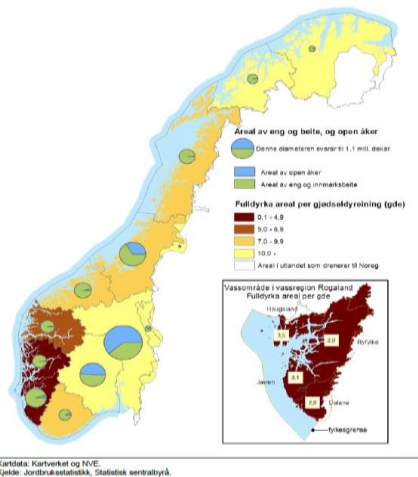
Website: https://www.regeneration-academy.org/

Soil health in Norway

Country: Wageningen / As, Norway

Host institute: Wageningen University/ NIBIO Norway

Spatial distribution of land use in Norway

Indicators of soil health

Project description

Soil degradation negatively impacts soil ecosystem services (ES), which is defined as the benefits people obtain from ecosystems. In Norway, the most prominent soil degradation processes are erosion by water, soil compaction, decline of soil organic matter and soil biodiversity loss. Methodologies and tools for assessing soils are necessary to monitor soil degradation, to evaluate land management strategies, whilst also considering soil ES that are beneficial to human beings. The concept of soil health has recently gained attention in this regard. The food and Agriculture Organization of the United Nations (FAO, 2008) defines soil health as:

"the capacity of soil to function as a living system, with ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health. [...]". Soil health cannot be measured directly, but is evaluated through measurements of physical, chemical and biological soil indicators. In this thesis, you are invited to come to Norway to assess soil health through soil sampling, lab and data analysis. Your approach can of course be adapted according to your interests and will depend also on the travel restrictions / possibilities related to the development of the COVID Pandemic.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Contact

Supervisor(s): Loes van Schaik, Frederik Boe, Jannes Stolte
Examiner: tbd
Contact details: loes.vanschaik@wur.nl;

Impacts of global change on soil health and ecosystem services in Mediterranean environments

Country: Spain
Host institute: Spanish Research Council (CEBAS-CSIC)
Online possible: No

Project description

At the Soil and Water Conservation Research Group in Murcia (Spain), we focus on monitoring and modelling the impacts of global change and Sustainable Land Management (SLM) on soil health, water security, and ecosystem services in Mediterranean and semi-arid environments. We aim to assess the potential of SLM for climate change adaptation and mitigation and for holistic landscape restoration.

We monitor the farm level impacts of SLM practices on soil health indicators in collaboration with farmers at 12 experimental farms, including 2 farms with long-term monitoring data (>10yr). This includes, for example, indicators of chemical, physical and biological soil health, greenhouse gas fluxes, soil erosion, and crop yield.

We develop and apply hydrological and soil erosion models like SPHY-MMF to assess the regional scale impacts of global change and SLM. These models are often tested in a catchment with high field data availability, and applied to larger catchments to assess the upscaling potential of adaptation measures (e.g. SLM, Nature-based Solutions, landscape restoration).

Possible current ***thesis topics*** include:
• Evaluation of the farm-scale impacts of SLM practices on physical, chemical, and biological soil properties and related costs and other benefits of implementation.
• Optimization of land management scenarios for climate change adaptation through modelling their impacts on soil erosion and water security indicators (SPHY-MMF).

Project details
Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: tbd
End date: tbd

Used skills: depending on the topic; fieldwork, laboratory analysis, GIS, modelling, interviewing, MCA analysis
Requirements: tbd, depending on the topic

Contact
Supervisor(s): Jantiene Baartman, María Martinez-Mena, Carolina Boix-Fayos, Joris de Vente, Joris Eekhout
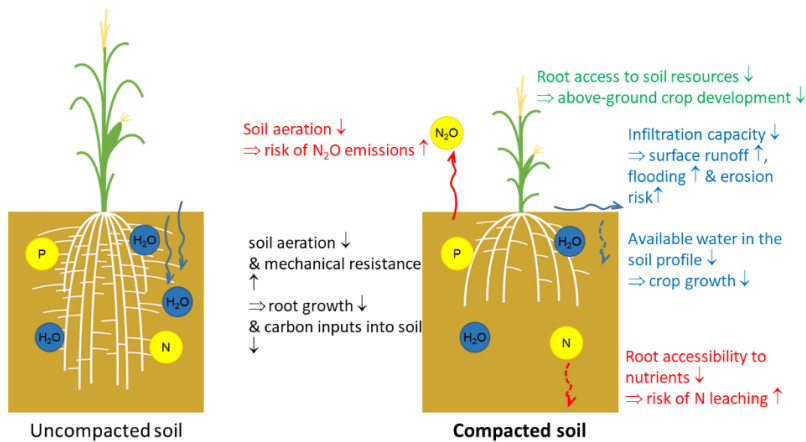Examiner: Coen Ritsema
Contact details: jantiene.baartman@wur.nl

Soil compaction research in the Netherlands

Country: Netherlands

Host institute: Wageningen environmental research

Online possible: No

Uncompacted soil   Compacted soil

Project description

Soil compaction affects crop growth. This can be hampered by limitations of water and air management and rootability. It is only known to a limited extent which of these three factors is the most decisive and how they differ for the various soil types and crops. Boone (1988) and Håkansson & Lipiec (2000) have already given indications in their studies how the various factors depend on the pore pressure and density/porosity. If it is not sufficiently known which factors inhibit plant growth, it is also impossible to properly assess whether a soil can be regarded as compacted and whether this applies to all crops. Soil compaction in the field is now often determined on the basis of dry bulk density and resistance to penetration. However, it appears that these two values cannot properly explain the reduction in plant growth. Also because, if provided with sufficient water and nutrients, plants can grow well even in highly compacted soils.

The aim of the research is to determine the consequences of soil compaction on plant growth and water management, as a result of which:
• It is easier to predict which drought and wetness damage crops will incur with further soil compaction.
• It can be better determined and measured to what extent which soils are compacted or are sensitive to compaction.
• Targeted measures can be indicated to prevent further soil compaction and the negative consequences for plant growth caused by agricultural vehicles.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin and end date: to be decided with the student

Used skills: vary with the sub-topic but can include fieldwork or modelling
Requirements: varies with the sub-topic selected

Contact

Supervisor(s): Loes van Schaik / Jos van Dam, Guido Bakema
Examiner: Coen Ritsema
Contact details: loes.vanschaik@wur.nl, guido.bakema@wur.nl
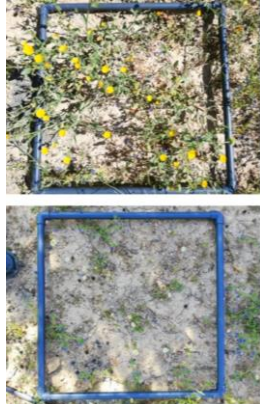
Assessing erosion in Mediterranean orchards under different management

Country: Portugal

Host institute: MED, University of Evora

Project description

Problem context

The increase in wine and olive oil demand is triggering the intensification and expansion of olive grooves and vineyards, by means of a systematic use of chemical fertilizers, herbicides and aggressive soil management practices. This intensification process leads to a reduction of the semi-natural Montado, a more resilient and sustainable ecosystem, leading to simplified landscapes with low-nature-value vineyard and olive grooves, which often results in negative environment impacts. Some solutions (ecologic management, application of mulch and/or biochar) are being addressed in the framework of several projects in the MED research center (SOLVO, SOLVIT, BIOMONTADO, SUSTAINOLIVE; https://www.med.uevora.pt/) to increase the sustainability of these farming systems by reducing soil erosion and increase soil carbon fixation. Typically, soil erosion models have been used to estimate the goodness-of-fit of these measures, but have rarely been validated with erosion field measures.

Research Objective: The main aim of the work is to predict and validate the soil erosion estimates of soil erosion models at different spatial and temporal scales. The specific objectives can be some of the following:

1. Field monitoring of soil erosion using sediment fences on plots of different sizes;
2. Assessment of key factors affecting the erosion processes (soil cover, rainfall parameters, soil compaction in each microenvironments, such as tree row, rut or inter-rows);
3. Assess the suitability of empirical soil erosion models (RUSLE; MMF – Morgan Morgan Finney) to predict the hydrologic and erosion responses using the above-mentioned dataset;
4. Develop soil erosion maps for each farming system and find critical points to develop soil erosion mitigation actions.

Expected research methods: The workplan involves the following tasks:

1. Field data collection and compilation of additional ancillary data;
2. Runoff-erosion modelling with RUSLE and/or MMF, including initial parametrization, model calibration and validation;
3. Development of validated soil erosion maps and intervention areas in need of soil degradation mitigation treatments.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin and end date: to be determined

Used skills: Modelling, fieldwork, data compilation.
Requirements: GIS Skills, soil sciences, meteorology, hydrology and erosion modelling.

Contact

WUR Supervisor: Joao Nunes
Host Supervisor: Sergio A. Prats / José Muñoz-Rojas
Examiner: Coen Ritsema

Contact details: joao.carvalhonunes@wur.nl

Soil at Regenerative Apple Cider Orchard

Country: Spain, Asturias, Green Spain

Host institute: The Knitted Forest

Online possible? : No

Project description – Bodem

We started **the Knitted Forest** out of the desire to start a **regenerative farm.** First at our family land in Noordwijk, named NoordwIJde, and then we moved to Spain to be able to buy a larger plot of land.

Our farm is located in a very green part of Spain and consists of 6 hectares of **apple cider trees**. The farm used to be exploited by a commercial agrofirm that used many pesticides. We changed these practices and are now in the **ecological** certification process.

A **food forest** of 400 trees has been planted as well as a **no-dig market garden** of 2000m2. A testplot of 300m2 will be planted with **hemp** for it's regenerative qualities and to investigate **textile fibre** possibilities. To maintain the land we also keep a flock of Merino and Border Leicester sheep for silvo pasture purposes, whose fibers are being used.

The soil degradation is significant as by the results of the taken soil sample tests. However, the organic matter is not low, but we lack mostly nutrients as nitrogen, potassium and phosphate. Another reason for degradation is the earlier use of pesticides, like RoundUp under the apple trees.

Projects

We believe that research is possible on a variety of specific soil degradation topics. The focus can lay in determining the current state of the land, especially the amount of chemicals and microplastics found. With these results we have determined two projects

1. We would like to focus on improving the soil for the organic apple cider orchard to enhance the quality of the apples, and increase the yield.
2. Another project that we would like to investigate is an agroforestry research on the apple cider tree orchard and with which valuable crop it can be combined to enhance the soil. Hemp is a possible crop for us.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: September 2024
End date:

Used skills:
Requirements: (e.g. GIS skills, followed a specific course)

Contact

Supervisor(s): Gerbrand Marbus & Elze van Veenendaal
Examiner:
Contact details: gerbrand@theknittedforest.com

WAGENINGEN
UNIVERSITY & RESEARCH

Agroecological soil management in chestnut agroecosystems: Impacts on soil quality

Country: Spain
Host institute: CEBAS-CSIC & INGENIO (CSIC-UPV)
Online possible: tbd

Project description

Agroecology can restore degraded lands by implementing sustainable soil management practices that enhance soil functions, such us water infiltration, soil fertility, and regulation of pests and diseases. The sustainability of chestnuts agroecosystems in Sierra de Aracena (Huelva), in southwest of Spain, is being challenged by several threats affecting tree decay and performance, including the expansion of soil borne diseases such as phytophthora infections. Climate change and unsustainable farming practices are major drivers jeopardizing the sustainability of chestnuts agroecosystems. The objective of this work is to assess the potential of two different agroecological soil sustainable managements (SSM) (no tillage, and no tillage with implementation of green covers) to enhance soil quality (physical chemical and biological indicators) and tree performance, and control potential phytophthora infections in chestnut farms in southwestern Spain.

Research objectives / potential thesis topics:

- To unravel the potential of different agroecological SSM to enhance soil quality, tree performance and control phytophthora infections.

Methodology

Field work (Sierra de Aracena, Huelva) (September), lab analysis of soil physic-chemical and biological indicators (1 month in Murcia), data analysis and reporting (2 - 4 months – Flexible location)

What is expected from the student?

Flexibility to travel across Spain, pro-activity and certain autonomy, previous knowledge on soil quality, enthusiasm for learning and capacity to deal with uncertainty.

Project details

Group: Soil Physics and Land Management group

Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: 1 Sept 2024
End date: End of December 2024

Used skills: fieldwork, laboratory analysis, data analysis, reporting
Requirements: Knoweldge on statistical tools (R or SPSS)

Contact

Supervisor(s): Raquel Lujan (Spain), Jantiene Baartman (SLM)
Examiner: Coen Ritsema
Contact details: jantiene.baartman@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Soil carbon storage in successional agroforestry systems

Country: Portugal

Host institute: Polytechnic of Coimbra, Coimbra Agriculture School

Online possible: No

Project description

Problem context:

The Mediterranean region faces growing challenges due to climate change, impacting traditional agricultural systems. There is a pressing need to explore sustainable alternatives that adapt to these changing conditions. Successional agroforestry systems (food forests) hold promise in addressing this challenge. However, there is a critical knowledge gap concerning the dynamics of soil carbon within these systems, which requires further research.

Research objective:

The primary objective of this research is to comprehensively assess the dynamics of soil carbon in successional agroforestry systems, particularly food forests, within the context of a changing Mediterranean climate. We aim to understand the factors influencing soil carbon sequestration, evaluate the impact of different agroforestry practices on soil carbon dynamics, and identify effective strategies for enhancing carbon storage in the soil.

What is expected from the student (type of research):

The research will involve a combination of fieldwork and laboratory analysis to quantify soil carbon dynamics in successional agroforestry systems. Students will gain practical experience in soil science, carbon sequestration assessments, and data analysis.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin date: flexible

Used skills: fieldwork, lab analyses, potentially modelling
Requirements: Fundamentals of Land Management (SLM31306)

Contact

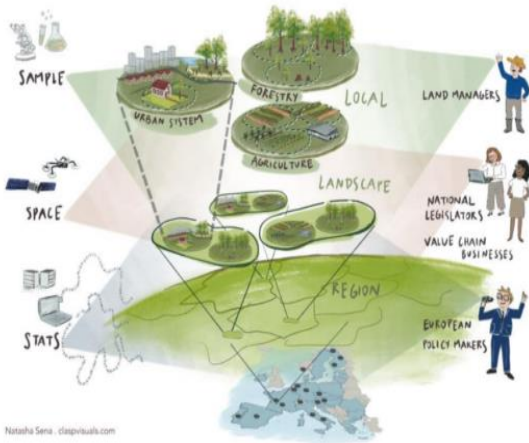Supervisor(s): Luuk Fleskens and Pedro Soares
Examiner: tbc
Contact details: luuk.fleskens@wur.nl

The effect of management practices on soil functions

Country: Europe
Host institute: various options
Online possible: Yes

Project description

Problem context:

How we manage our soils can both negatively and positively impact the capacity of our soils to function. However, the effect of specific practices on soil functions is not always well understood. On the one hand we often measure the effect of different practices on the soil's condition, but rarely make the link to soil functions. On the other hand, the same practice may lead to different effects depending on a range of factors, such as climate or soil texture.

To better understand the effect of management practices on specific soil functions (i.e. primary productivity, nutrient cycling, climate and carbon regulation, water purification and regulation or biodiversity and habitat provision) we have developed a theoretical framework to link management practices to soil processes and functions. As part of our wider European project Benchmarks, we are testing the link between specific indicators and soil functioning in multiple case studies throughout Europe. Additionally, we are testing the suitability of different methods, from field to remote sensing methods to evaluate the intensity of land use practices as well as their effect on soil functions.

If you have an interest in the impacts of management practices on soil functions, and/or an interest in exploring diverse methods of measurements, do not hesitate to contact us!

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL & MEE

Begin date: flexible

Used skills: variable
Requirements: Fundamentals of Land Management
(SLM31306) or equivalent soil-related course

Contact

Supervisor(s): Luuk Fleskens
Examiner: tbc
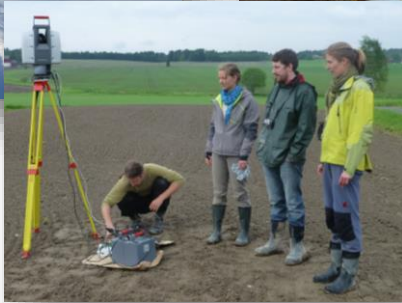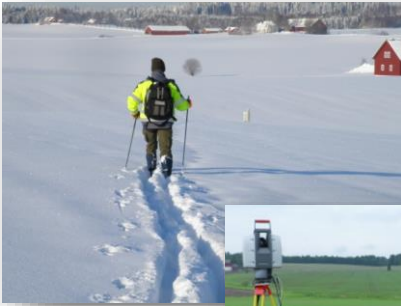Contact details: luuk.fleskens@wur.nl

Snowmelt, soil erosion and NBS in Norway

Country: Norway

Host institute: NIBIO

Online possible: To be discussed

Project description

Problem context

One of the research themes of NIBIO in Southern Norway (Ås) is the understanding of water pathway processes in small catchments and to define small, local measures for reducing peak flow and soil loss.

Research Objective/Question

Depending on the interests of the student, and the time of the year, several research topics can be formulated, e.g.:
• Gully erosion: modelling and measuring
• Soil erosion after spring snowmelt periods
• Effectiveness of local soil conservation measures for erosion control and peak flow reduction
• Modelling soil erosion, with focus on cold climate processes

What is expected from the student (type of research)

• Mix of fieldwork, laboratory and data analysis. Fieldwork could consist, depending on the research focus, of sampling and measurement of soil and vegetation characteristics, measurement of runoff and soil loss from small catchments and snow dynamics measurements, acquisition and processing of aerial photography (drone) and/or satellite imagery.
• There are also options to combine the above with runoff and erosion models.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: varying with project, but e.g. GIS, modelling, data analysis, fieldwork
Requirements: see above

Contact

Supervisor(s): Jantiene Baartman & Jannes Stolte
Examiner: Coen Ritsema
Contact details: jantiene.baartman@wur.nl

Sediment and nutrient dynamics in agroforested catchments in NW Iberian Peninsula

Country: Spain

Host institute: University of Vigo, Campus Ourense

Project description

The line of research focuses on the field of soil and water conservation. More specifically, it is engaged in studying sediment and associated pollutants (nutrients and metals) transport, processes and pathways in humid, temperate environment using a combination of interdisciplinary knowledge of climatology, hydrology, soil sciences, and geochemistry. Of particular interest is the study of runoff events, which mobilise large proportions of sediment and associated pollutants in catchment systems. Different study subjects can be conducted within this scope for a master's thesis or internship. Below is a list of research topics of interest for master´s thesis. Students are, however, encouraged to propose their own research topics related to this research field.

▪ Exploring the hydrologic functioning and nutrient dynamics in rural catchments of the NW Iberian Peninsula. This study will be combined with model-based analysis to extrapolate results to other ungauged catchments with similar climate, geomorphological, and land use characteristics.

▪ Application of hydrologic models to investigate the impact of environmental characteristics and human activities on water quantity and quality at a subdaily scale in agroforested catchments in the NW Iberian Peninsula. Finally, it will be used to predict future situations (not just the effects of climate change, but also the effects of land use change, management practices, and conservation measures) and develop strategies to mitigate the potential negative effects.

Project details

Project type: Thesis
Study programme: MIL & MEE

Begin and end date: to be decided with the student

Used skills: vary with the sub-topic but can include fieldwork, modelling, GIS skills
Requirements: varies with the sub-topic selected

Contact

WUR supervisor: Joao Nunes
Host Supervisor: Maria Luz Rodríguez-Blanco
Examiner: Coen Ritsema
Contact details: joao.carvalhonunes@wur.nl

Soil degradation by fire and erosion & soil conservation through mulch and biochar

Country: Portugal

Host institute: CESAM, University of Aveiro,

Online possible: To be discussed

Project description

Three of the principal research themes of the soil conservation researchers at CESAM are the understanding of: (i) wildfire-enhanced soil erosion processes and their mitigation; (ii) post-fire soil and ecosystem carbon fluxes; (iii) soil improvement through biochar application.

Research Objective/Question

Depending on the interests of the student, and the time of the year, several research topics can be formulated, e.g.:

• measuring and/or modelling of post-fire soil erosion and wildfire ash mobilization and the effectiveness of emergency stabilization measures such as mulching;
• measuring the so-called Birch effect from wildfire ash, i.e. carbon effluxes induced by simulated rainfall;
• measuring the impacts of biochar type and application rates on the sponge function of soils.

What is expected from the student (type of research)

Ideally, the student will do a mix of fieldwork, laboratory work and data analysis or modeling, with the focus of the efforts depending on the research topic. Fieldwork could consist of recording or measuring vegetation and soil properties (e.g. soil water repellency), collecting eroded sediment and soil samples, and gathering data from rainfall and soil moisture sensors. Laboratory work could include the laboratory analysis of collected soil and eroded sediment samples, doing rainfall simulations on soil columns, or simulating rainfall-runon events of wildfire ash mobilization.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: varying with project, but e.g. GIS, modelling, data analysis, fieldwork
Requirements: see above

Contact

Supervisor(s): Jantiene Baartman, Joao Nunes, Jacob Keizer, Frank Verheijen
Examiner: Coen Ritsema
Contact details: jantiene.baartman@wur.nl

Wildfire effect on soil erosion and plant recovery and post-fire

Country: Spain

Host institute: Castilla La Mancha University (Albacete Campus)

Online possible: To be discussed

Project description

Wildfires disturb Mediterranean ecosystems and affect soil hydrological properties, often leading to increased runoff and erosion. To mitigate fire effects, prescribed fires are used to removes or reduces the plant material that is prone to forest fires by creating fuel discontinuity and minimising fire intensity. This forest management measure potentially impacts Mediterranean ecosystems' hydrological response and plant biodiversity by influencing water infiltration into soil and directly burning vegetation.

Postfire restoration practices encompass those which aim to reduce negative wildfire impacts and to improve burned area rehabilitation. Mulching, Contour-felled log debris (CFD) and log erosion barriers (LEB) are techniques used worldwide on hillslopes after wildfires to avoid soil erosion. In this context, it is essential to evaluate how these restoration techniques can affect soil and plant ecosystems by increasing or decreasing wildfire impacts.

Research Objective/Question

Multiple research questions can be addressed, depending on the student's interests and the host availability. E.g.:

- Evaluate the effects of prescribed fires severity on soil erosion and plant diversity under semiarid conditions.
- Evaluate the effects of postfire hillslope stabilisation techniques (Mulching, log erosion barriers and contour-felled log debris) on soil quality, nutrient content and plant biodiversity.
- Estimate the change in connectivity due to fire and post-fire management, using connectivity indices (GIS calculations and analysis) using high resolution data

What is expected from the student (type of research): Research methods vary and may include: Fieldwork including soil and plant biodiversity surveys and biomarkers of the soil microbial community's; Lab analyses including soil bulk density and other physicochemical soil properties (soil texture, OM, …); Statistical analyses; Soil erosion and connectivity modelling

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: varying with project, but e.g. GIS, modelling, data analysis, fieldwork
Requirements: see above

Contact

Supervisor(s): Jantiene Baartman & Manuel Esteban Lucas Borja
Examiner: Coen Ritsema
Contact details: jantiene.baartman@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Estimating PM10 dust emissions using the PI-SWERL

Country: Netherlands

Host institute: WUR

Online possible ? : No

Project description

The PI-SWERL (Portable In-Situ Wind Erosion Laboratory) is a portable instrument that provides an alternative to a classic field wind tunnel. Due to it rather small size and weight it can be used to measure wind erosion thresholds and dust emissions from any kind of surface provided the roughness elements on the surface are smaller than approximately 5 cm. As such, it is suited to measure the wind erosion threshold and dust emission on (almost) bare agricultural surfaces and on most surfaces found in cities (streets, sidewalks, grass parks, etc.). In this thesis the student will use the PI-SWERL to determine the wind erosion threshold and dust emissions on various surfaces in and around the city of Wageningen.

The selection of surfaces will be made after discussion with the student and the need for data from atmospheric modelling research that is currently conducted at Wageningen University. The student will be expected to carry out the measurements and calculate the wind erosion threshold and the dust emission fluxes, compare the different surfaces that have been selected, and interpret the results. If interested the student will also have the opportunity to assist with incorporating the results of the study in one or more atmospheric models currently under development at WUR.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: flexible
End date: flexible

Used skills: -
Requirements: -

Contact

Supervisor(s): Mahrooz Rezaei, Dirk Goossens
Examiner: Michel Riksen
Contact details: mahrooz.rezaei@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Emerging crops in sustainable agriculture

Country: Spain

Host institute: Spanish Research Council (CEBAS-CSIC)

Online possible: No

Project description

At the Abiotic Stress Research Group in Murcia (Spain), we focus on the study of abiotic stress tolerance mechanisms in plants, mainly salinity and water stress. We aim to assess the introduction of neglected, underutilised (NUS) and non-invasive emerging crops such as quinoa and moringa, tolerant to abiotic stress for sustainable agriculture and to evaluate the potential of these crops to adapt to climate change.

Our group is currently working on species of agronomic interest such as tomatoes, and in recent years we have introduced species considered superfoods such as quinoa and moringa. Due to the current situation of our agriculture, it is necessary to improve the development of crops in areas where conditions are unfavourable. A challenge for our group is to use the genetic background of wild salt-tolerant species and halophytes to recover tolerance traits. For this purpose, we use different techniques such as the study of different tolerance mechanisms by omics, proteomics, genomics and metabolomics.

Research questions:

-Does quinoa have unique (so far unknown) mechanisms of adaptation, and therefore growth and completion of its life cycle, under high salinity conditions?

-Can halophytes and glycophytes have similar physiology and anatomy (except glands), and do halophytes make more efficient use of the same salt tolerance mechanisms (Shabala and Mackay, 2011)?

-Are GAs involved in these mechanisms?

Possible *thesis topics* include:

• Unravelling new mechanisms of salinity tolerance in *Chenopodium quinoa*: Role of glycinabetaine.

• Water stress response mechanisms in *Moringa oleifera*.

• The role of gibberellins in adaptation to salt stress in tomato plants..

Project details

Group: Abiotic Stress, Production and Quality
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: tbd
End date: tbd

Used skills: depending on the topic; germination and growth of plants in growth chambers and greenhouses greenhousework, laboratory analysis
Requirements: tbd, depending on the topic

Contact

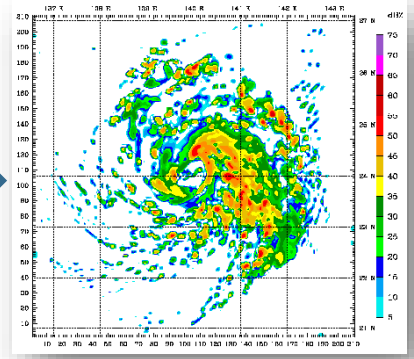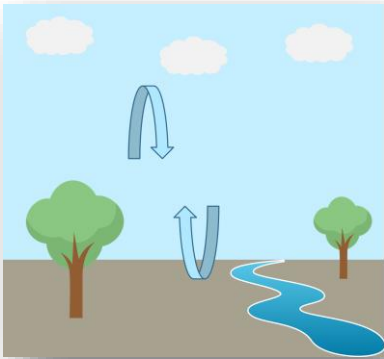Supervisor(s): Klaas Metselaar, Nieves Fernandez-Garcia and Enrique Olmos
Examiner: tbd
Contact details: Klaas.Metselaar@wur.nl

Modeling the atmospheric transport and deposition of microplastics in Portugal

Project description

Problem context

Microplastics are ubiquitous in the environment. The main sources of microplastics are in the terrestrial environment, and thus it is questionable how microplastics are transported from these sources to other locations. Nevertheless, the transport processes between different environmental compartments (soil and air for example) is poorly studied. Modeling enables the simulation and prediction of the transport of pollutants through different media. Weather Research and Forecasting Model (WRF) is an example of such models that can simulate the atmospheric processes of aerosols, including emissions, transport, and deposition. This model has the potential to get parametrized for airborne microplastics. Validating the model results, however, needs field measurements of microplastics which are not always easy to acquire. For this study, we got extensive data of microplastic emission and deposition in Portugal which can be used for validating the model.

Research Objective/Question

Improve and validate the WRF model for microplastic atmospheric transport and deposition research, using measured data of emission and deposited microplastics in Portugal. The main research question is therefore "how do the simulated and observed deposition of microplastics compare?

What is expected from the student (type of research)

We are looking for an attentive and resilient student who enjoys modeling work. The student is willing to apply new data from the field as an input for the atmospheric model (WRF).

Project details

Group: Meteorology and Air Quality
Project type: Thesis
Starting date: Periods 2 or 3

Used skills: Modeling,
Requirements: Being familiar with the WRF model
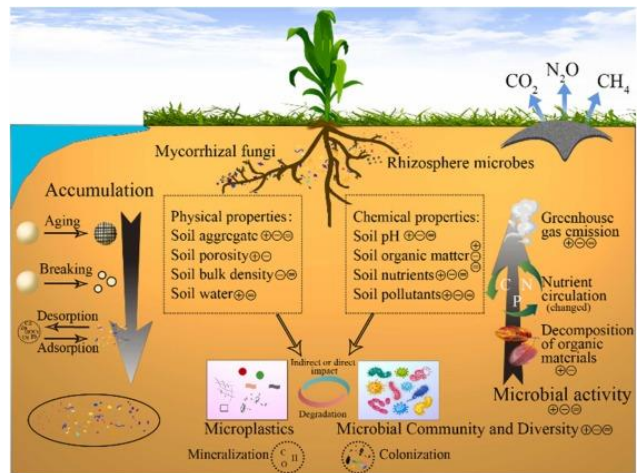
Contact

Supervisor(s): Mahrooz Razaei (SLM/MAQ),
Inês Amorim Leitão (SLM), …
Contact details: mahrooz.razaei@wur.nl

![Wageningen University & Research logo]

How MicroPlastics affect soil structure and their transport with runoff and erosion

Country: NL / laboratory experiment
Host institute: t.b.d. / NA
Online possible: depending on topic

Photo: JB, in Rwanda

Wang et al., 2022 Journal of Hazardous Material

Project description

Mass flows of microplastics (MPs; < 5 mm) into soils are estimated to be 40 times larger than those into waters, highlighting the role of soils in the plastic cycle. MPs can affect soil hydro-physical properties, such as soil structure, water holding capacity, infiltration rate etc., as well as the abundance and activity of soil biota such as earthworms. However, the evidence on how MPs, in combination with soil biota, affect soil structure is scarce and contradictory, while this in turn potentially affects runoff generation and erosion on sloping lands. While erosion is the most important land degradation process worldwide, how and how many MPs are transported with runoff and erosion is virtually unknown.

Research Objective/Question

The MASTER project aims to unravel and quantify how MPs affect soil structure formation and soil hydrology and how this, in turn, affects MP transport with runoff and erosion using various complementary methods. Two PhD students started this project on 1 Dec 2023. Depending on the student's interested and timing of the thesis, potential research questions include:
- Investigate how microplastics influence the formation and stability of soil aggregates;
- Unravel how this soil structure formation, under influence of MPs, changes soil hydro-physical properties;
- Quantify MP transport with runoff and erosion at field scale;
- Investigate how soil structure and hydrological properties affect runoff generation, erosion and MP transport in rainfall simulation experiments

What is expected from the student (type of research)

Depending on the exact research topic, various activities will be carried out, ranging from setting up and carrying out mesocosm or rainfall simulation experiments, MP and soil sample analysis in the lab, data analysis or fieldwork.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: laboratory, experiments, fieldwork, data analysis
Requirements: t.b.d.

Contact

Supervisor(s): Qi Liu, Monne Weghorst, Loes van Schaik, Jantiene Baartman
Examiner: Coen Ritsema
Contact details: loes.vanschaik@wur.nl or jantiene.baartman@wur.nl
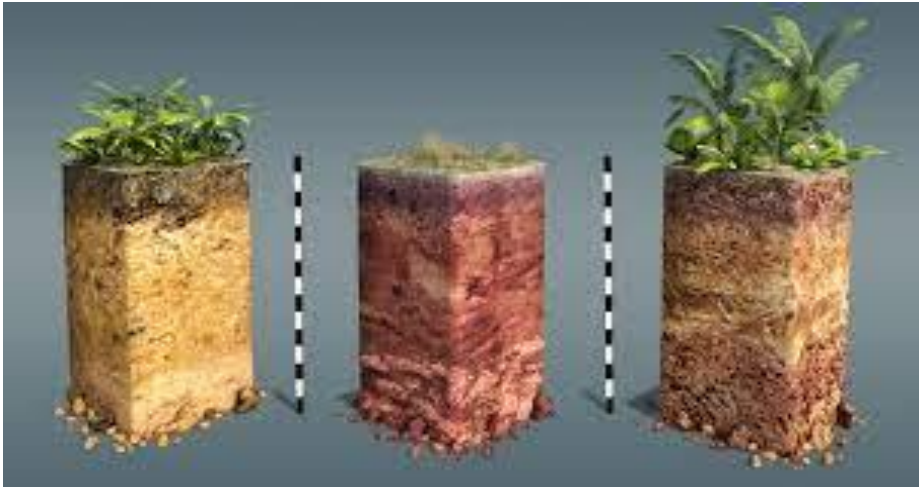
WAGENINGEN
UNIVERSITY & RESEARCH

Abiotic transport of pesticides along microplastic-contaminated soil profiles

Country: The Netherlands

Host institute: Wageningen University (SLM)

Online possible ? : No

Project description

Pesticides and microplastics are two classes of emerging pollutants in agricultural lands. The presence of microplastics from agricultural activities may affect the behaviors of pesticides in soil. In the MINAGRIS-project (https://www.minagris.eu/), we are investigating the vertical transport of pyraclostrobin (a commonly used fungicide) in MP-contaminated soil.

Research objective

This thesis project aims to assess the transport of pyraclostrobin in three types of soils (sandy, loamy sand, clay soil) with the presence of various microplastics. To address these, a soil column experiment will be conducted to simulated the transport of pyraclostrobin in field condition to achieve following objectives.

1) Assessing the effects of microplastics on transport of pyraclostrobin in soil with different texture.
2) Assessing the effects of various types of microplastics on transport of pyraclostrobin along soil profile

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date: Apr/May. 2024
End date: to be determined

Used skills: literature review, data analysis, scientific writing
Requirements: basic knowledge of statistics

Contact

Supervisor(s): Xiaomei Yang, Gaowei Tan
Examiner:
Contact details: xiaomei.yang@wur.nl, gaowei.tan@wur.nl
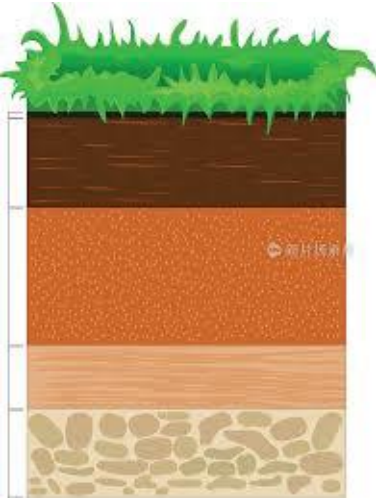
Biotic transport of pesticides along microplastic-contaminated soil profiles

Country: The Netherlands

Host institute: Wageningen University (SLM)

Online possible ? : No

Project description

Except of irrigation-driven transport of pesticide in microplastic-contaminated soil, preferential flow through earthworm burrows also plays an important role in pesticide transport. In the MINAGRIS-project (https://www.minagris.eu/), we are investigating the transport of pyraclostrobin through earthworm burrows in in MP-contaminated soil.

Research objective

This thesis project aims to assess the transport of pyraclostrobin earthworm burrows along soil. To address these, a soil column experiment will be conducted to simulate the field condition

1) Assessing the transport of pyraclostrobin inside and outside of the earthworm burrows.
2) Assessing the transport of microplastics inside and outside of the earthworm burrows.
3) Assessing the effects of soil textures and microplastic types on transport of pyraclostrobin through earthworm burrows

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date: Apr/May. 2024
End date: to be determined

Used skills: literature review, data analysis, scientific writing
Requirements: basic knowledge of statistics

Contact

Supervisor(s): Xiaomei Yang, Gaowei Tan
Examiner:
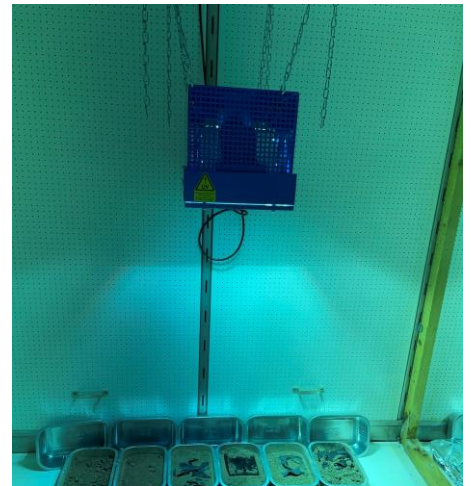Contact details: xiaomei.yang@wur.nl, gaowei.tan@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Microplastic fragmentation and effects on soil quality

Country: The Netherlands

Host institute: Wageningen University (SLM)

Online possible ? : No

Project description

Problem context

Microplastics could be fragmented through biodegradation, ultraviolet radiation and mechanical wear processes. However, the processes of microplastic fragmentation and the effects on soil quality are not well addressed yet.

Research objective

Our main goal is to investigate the fragmentation behavior of microplastics in soil under various factors (UV radiation, mechanical wear, and biodegradation), as well as the effects on soil quality. This objective will be conducted in pot experiment.

Main approaches

- Design and setup a pot experiment
- Evaluate the effects of microplastic types, soil types, fragmentation factors (UV, mechanical wear and biodegradation) on microplastic fragmentation processes
- Evaluate the effects of fragmentation processes of microplastics on soil quality

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date: flexible
End date: flexible

Used skills: literature review, data analysis, scientific writing
Requirements: basic knowledge of statistics

Contact

Supervisor(s): Hanyue Zhang, Xiaomei Yang
Examiner:
Contact details: xiaomei.yang@wur.nl
hanyue.zhang@wur.nl

Microplastic transport behavior with earthworms in soil profile

Country: The Netherlands

Host institute: Wageningen University (SLM)

Online possible ? : No

Project description

Problem context

Microplastics are prone to be migrated along soil profile by soil organisms and percolating water, or even possibly enter groundwater. However, fewer studies focus on microplastic transport behavior in natural soil using large scale soil columns. Based on the research themes of MINAGRIS-project (https://www.minagris.eu/), we will therefore investigate the microplastic transport behavior with earthworms in natural soil.

Research objective

The main aim of the work is to investigate the effects of earthworms and different irrigation intensity on microplastic transport behavior in soil profile. The experiments will be conducted using soil columns.

Main approaches

- Design and setup a soil column experiment
- Evaluate the effects of microplastic types, soil types, earthworms and irrigation intensity on microplastic transport behavior

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date: May or later (to be discussed)
End date: to be determined

Used skills: literature review, data analysis, scientific writing
Requirements: basic knowledge of statistics

Contact

Supervisor(s): Hanyue Zhang, Xiaomei Yang
Examiner:
Contact details: xiaomei.yang@wur.nl
hanyue.zhang@wur.nl

Assessing the Vertical Transport and Fate of Microplastics in Soil

Country: The Netherlands

Host institute: Wageningen University (SLM)

Online possible: Partially

Project description

This research aims to investigate the vertical transport of microplastics within soil over one year, focusing on the behaviors of three distinct plastic types: Low-Density Polyethylene (LDPE), Polybutylene Adipate Terephthalate (PBAT), and Starch-based plastics. To achieve this, experimental columns were inserted into the soil, each containing a microplastics-spiked layer at the top 10 cm. Over the course of the study, we will monitor and analyze the movement and distribution of microplastics within the soil profile, with a particular emphasis on their penetration into deeper layers. This research addresses a critical gap in our understanding of the environmental fate of different plastic types, providing valuable insights into the potential long-term fate of microplastics inside the soil.

Research Objectives:

1. Evaluate the vertical transport of microplastics, specifically LDPE, PBAT, and starch-based plastics, within soil columns over one year.

2. Assess the spatial distribution of microplastics in different soil layers to understand their penetration and movement dynamics

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date: Apr/May. 2024
End date: to be determined

Used skills: literature review, data analysis, scientific writing
Requirements: basic knowledge of statistics

Contact

Supervisor(s): Xiaomei Yang, Rozita Soltani Tehrani
Examiner: Xiaomei Yang
Contact details: xiaomei.yang@wur.nl,
rozita.soltanitehrani@wur.nl
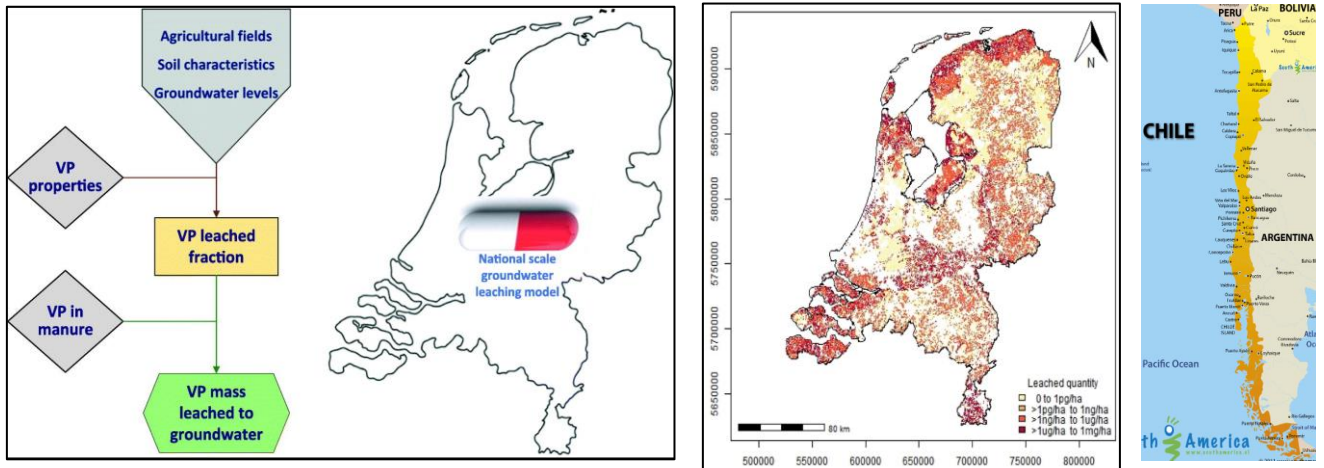
WAGENINGEN
UNIVERSITY & RESEARCH

Modeling Leaching Potential of Veterinary Pharmaceuticals in Chile

Country: Chile

Host institute: Pontificia Universidad Católica de Valparaíso and WUR

Online possible : Yes

Project description

Chile has been facing a megadrought since more than a decade ago. Therefore, water availability is essential for the Chilean government. Water availability is composed of water quality and water quantity. Studies on water quantity are commonly performed in Chile; however, water quality assessments for veterinary pharmaceuticals are not performed yet. Hydrological models are valuable for water quality assessments because they explicitly incorporate soil physical and chemical properties and boundary conditions over time.

The main goal of this thesis is to implement the methodology already established for the Netherlands to the case study of Chile. In a nutshell, work consists of implementing a hydrological model in Rscript using a dataset including: a soil database/characteristics, rainfall, land cover, and groundwater in Chile. Furthermore, veterinary pharmaceutical products will be obtained from the literature and based on the experience from the Netherlands.

The student can work mostly online (using our dataset) and/or travel to Chile. If you decide to travel, you can work with Dr. Carlos Faúndez on the Rscript project. Additionally, you can participate in fieldwork (optional, cost included) across Chile.

Project details

Group: Soil Physics and Land Management group
Project type: MSc Thesis
Study programme:

Begin date: to be determined
End date: to be determined

Used skills: Modeling, GIS, Rscript, Fieldwork(optional)
Requirements: GIS skills (basic), R script (basic)

Contact

Supervisor(s): Nikola Rakonjac Ph.D. and Carlos Faúndez Urbina Ph.D.

Examiner: Prof. Coen Ritsema

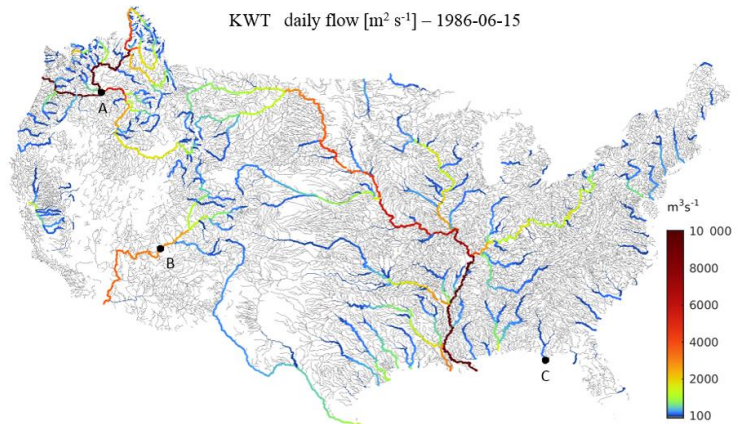Contact details: nikola.rakonjac@wur.nl

Characterization of large-scale diffuse nutrient pollution sources

Country: Portugal

Host institute: MED, University of Evora

Online possible?: yes (but ideally presential)

KWT daily flow [m² s⁻¹] – 1986-06-15

Project description

Problem context: The Water Framework Directive (WFD) and Nitrates Directive are clear about the goal of achieving good ecological and chemical status and restoration of aquatic ecosystems across Europe, and while nutrient reduction decisions and strategies are often made at the national scale (and the specific management actions taken often need to be tailored to very local scale conditions regarding combinations of soil type, climate and farming systems), large-scale simulations can be instrumental for linking EU policy recommendations with multi-scale decision-making processes (EU, national, region and local). Several global efforts are underway to provide simulation capabilities at such scales, with a primary emphasis on hydrological and hydrodynamic simulations aimed at offering comprehensive continental-level assessments of "water quantity", encompassing aspects like streamflow, flood risk, soil moisture, groundwater fluctuations, and more. However, there is a notable gap in research when it comes to hydrological-nutrient simulations at such scales. One of the challenges with such large-scale simulations is the need to characterize pollution sources for large areas with multiple land uses.

Objectives: The student will study strategies to identify and characterize large-scale diffuse pollution sources through a combination of satellite imagery, thematic maps, and GIS. Focus will be given to nitrogen and phosphorous, which are key nutrients used in fertilizers that lead to major pollution and eutrophication problems in Europe

Expected Research methods: The student will revise existing (and propose new) transfer functions for mapping and quantifying pollution sources that can be used in current large-scale nutrient simulation efforts. The student will integrate a very dynamic modelling team with experts and students from MED (UEvora, Portugal, https://ue-hydro.weebly.com/), the Universities of Calgary and Saskatchewan (Canada, https://uofs-comphyd.github.io/) and the National Center for Atmospheric Research (USA, https://staff.ucar.edu/users/mizukami).

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MEE

Begin and end date: to be determined

Used skills: QGIS or ArcGis (and ideally some programming such as Python, R, Matlab, Julia, or others)
Requirements: Hydrology and/or water quality

Contact

WUR supervisor: Joao Nunes
Host supervisor(s): Diogo Costa
Examiner: Coen Ritsema
Contact details: joao.carvalhonunes@wur.nl

Evaluating Urban Sources of Aquatic Pesticide Pollution and the Risk of Pesticide Pollution Mixtures in Western Cape rivers, South Africa

Country: South Africa

Host institute: Soil Physics and Land Management (WUR) and Earth Sciences (Stellenbosch University)

Online possible: Yes

(Flickr, 2017)

(Engineering News, 2021)

Project description

The Western Cape of South Africa has a Mediterranean climate, and an abundance of agriculturally productive land to support the wheat, fruit, wine, and citrus industries of the country. South Africa is also the leading pesticide user in Sub-Saharan Africa. Active ingredients within pesticide compounds can enter non-target environments such as surface and groundwater where they can persist and be a risk to the environment and human health.

Sixty pesticides and transformation productions were detected in the rivers of three agricultural catchments in the Western Cape. Most samples contained five or more pesticides. Aquatic pesticide pollution can potentially harm aquatic organisms, but there is still a limited understanding of the nature of the pesticide pollution sources (urban vs. agricultural) and how pesticide mixtures could increase the exposure risk (and toxicity) to aquatic organisms.

This project aims at analysing over 3 years of aquatic pesticide pollution monitoring data to evaluate the sources and potential risks pesticide mixtures have on the aquatic environment. Statistical and time-series analysis will be performed in R or other scripting languages (e.g., Matlab). Findings will help in the design of mitigation measures to effectively tackle pesticide pollution issues in the region.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Data Analysis Skills, Hydrogeology, Hydrochemistry, Hydrology

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
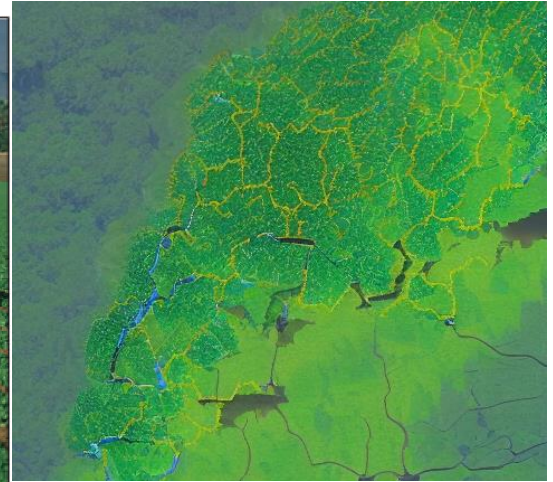Contact details: reynold.chow@wur.nl

Developing risk maps of aquatic pesticide pollution in rivers of the Czech Republic based on agricultural application patterns

Country: Czech Republic

Host institute: Soil Physics and Land Management (WUR)
Online possible: Yes

(USGS, 2023)

(Artificial Art, 2023)

Project description

Pesticide pollution in European rivers is a significant environmental concern with far-reaching implications for ecosystems, human health, and biodiversity. The primary goal of this project is to develop a comprehensive risk map depicting the potential for aquatic pesticide pollution in rivers across the Czech Republic. The focus will be on understanding and visualizing the impact of agricultural pesticide application patterns on water quality.

This project will include the analysis of general pesticide application patterns. The pesticide application patterns will then be linked to spatially distributed land use/crop types. Different crops have unique characteristics, pest pressures, and agricultural practices, which in turn impact the choice and intensity of pesticide use. GIS and modelling tools (e.g., ArcGIS, QGIS, R) that incorporate the relationships between pesticide application, land use, and hydrology will then be utilized to map potential pesticide concentrations in the rivers of the Czech Republic. Risk to the aquatic environmental can then be assessed by comparing the mapped concentrations with environmental quality standards.

This project aims to produce accurate and actionable risk maps that can guide environmental policies, support sustainable agriculture practices, and contribute to the preservation of water quality in rivers of the Czech Republic. The methodology developed in this project will then be applied across all of Europe.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Data Analysis Skills, GIS skills, Hydrochemistry, Hydrology

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl

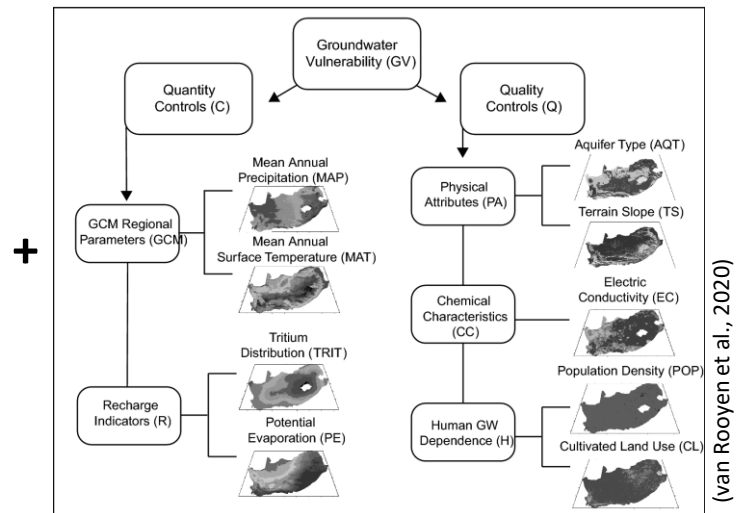# Mapping PFAS groundwater vulnerability in South Africa

Country: South Africa

Host institute: Soil Physics and Land Management (WUR) and Earth Sciences (Stellenbosch University)

Online possible: Yes

(SEACC, accessed 2023)

(van Rooyen et al., 2020)

Project description

South Africa is a drought prone country. As such protecting its water resources from contamination is one of the nation's highest priority. During times of drought groundwater plays a larger role as a source for drinking water and irrigation. However, over the years it has been determined that groundwater can become contaminated by a variety of pollutants.

In particular, a pollutant of emerging concern are per-/poly-fluoroalkyl substances (PFAS), also known in the media as the "Forever Chemical". PFAS have a variety of uses (e.g., pesticide, non-stick coating, fast food packaging) and are prevalent throughout society. PFAS are a class of micropollutant known to be very persistent in the environment. Therefore, it is possible that PFAS are contaminating certain aquifers in South Africa.

Very little research has been conducted on the state of PFAS contamination within South African aquifers. The aim of this research is to develop a groundwater vulnerability map for PAFS in South Africa to help identify hot-spots of potential contamination. The map will be developed through a GIS-based approach where spatial datasets will be overlain and weighted based on their contribution to the risk of groundwater contamination. Of particular importance to this project will be the identification of PFAS sources in South Africa and their spatial distribution throughout the country.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: GIS skills, hydrogeology

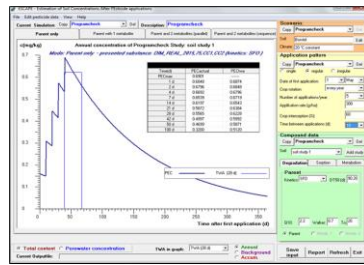## Contact

Supervisor(s): Reynold Chow
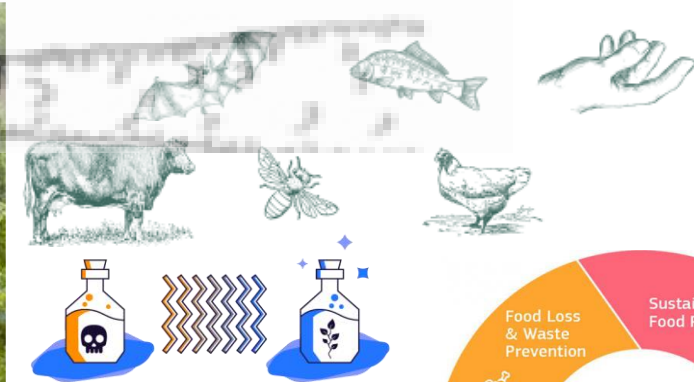Examiner: t.b.d
Contact details: reynold.chow@wur.nl

PESTICIDE PLANET
research, political, and social challenges

Current food production are caught in a "vicious circle": increasing pesticide use to increase yields, leading to worsening environmental degradation and escalating health costs. Re-evaluation of agronomic practices and implementation of strategies to overcome lock-ins of undesired status are necessary for safer and more sustainable production. The SLM-pesticides team is working on different spheres of the topic (monitoring, modeling, risk assessment, transition, etc), with national and international colleagues. Some of the MSc thesis topics available and to be further developed with the student:

· **Pollution status of European soils,** w/ Masaryk University (Czech), University of Bern (Switzerland)
· **Modelling wind erosion of pesticides <-> human exposure,** w/ Utrecht University (NL)
· **Impacts of mixtures of contaminants on beneficial insects,** w/ University of Aveiro (Portugal)
· **The impact of biochar on pesticide content and bioavailability in floral resources of a biodiverse pasture**, w/ University of Aveiro (Portugal)
· **Bio-pesticides assessment,** w/ University of Aveiro (Portugal)
· **Natural vs synthetic pesticides: contributions to reach the EU 2030 goals,** w/ University of Aveiro (Portugal)
· **Pesticide application patterns and occurrence across different matrices in Southwest China/Northern China Plain,** w/ China Agricultural University
· **Spatially distributed pesticide fate/leaching model for Europe/China,** w/ China Agricultural University
· **Sustainable agricultural practices for pollutants mitigation in Erhai Lake China** w/ China Agricultural University
· **Development of scenarios for pesticide risk reduction**
· **Pesticides meet SQAPP (soil quality app)**
· **Microbes for sustainable agriculture,** w/ NIOO
· ...

Project details
Group: Soil Physics and Land Management group
Project type: Thesis & internships
Study programme: MIL & MEE
Begin date: flexible

Contact
Contact: vera.felixdagracasilva@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Transformations and adaptations in African farming systems

Country: Egypt, Ethiopia, Kenya (WATDEV); Malawi, Tanzania, Zambia (FoSTA Health)

Host institute: FoSTA Health and WATDEV project partners

Project description

Problem context

Two new projects, FoSTA Health and WATDEV, are working on various transformation and adaptation options for African farming systems. The FoSTA Health project explores the implications of different food system transformations in southern Africa on human, animal and environmental health. Within Malawi and Tanzania this includes diversification options of maize production, and in Malawi and Zambia, the implications of land and water management transitions. The WATDEV project aims to improve the sustainability of agricultural water management and resilience of agricultural ecosystems to climate change in East Africa and Egypt.

Research Objective

There are various opportunities to support these projects through participatory field work exploring farmers' perspectives and autonomous adaptation strategies, as well as through technical and scenario-based (modelling) approaches. Get in touch for more information.

What is expected from the student (type of research)

Variable

Project details

Group: Soil Physics and Land Management group
Project type: Thesis (SLM-80336)
Begin date: Flexible
End date:

Used skills: Various possibilities
Requirements: Systems thinking

Contact

Supervisor: Luuk Fleskens
Examiner:
Contact details: luuk.fleskens@wur.nl
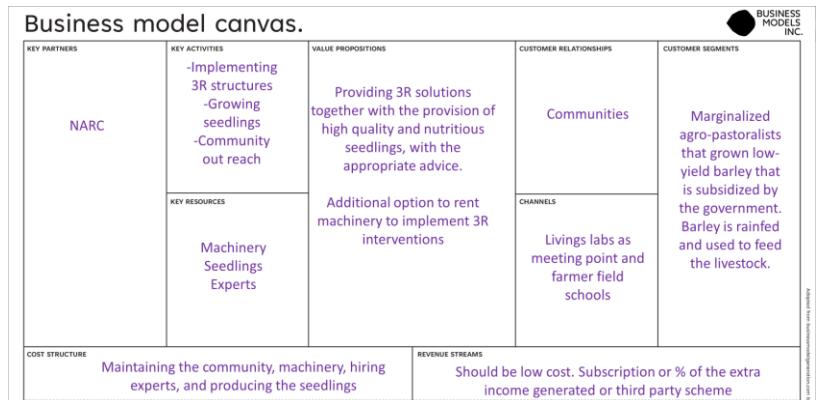
WAGENINGEN
UNIVERSITY & RESEARCH

Making Lasting Impact: Unravelling Customers'/Farmers' Preferences to Derive Viable Business Models for the Sustainable Scaling of Rainwater Harvesting in Jordan

Country: Netherlands / Jordan
Host institute: Acacia Water

Example of how a BMC could look like:

Project description

Jordan is one of the most water-scarce countries in the world, severely limiting the economy, agricultural development, food security, and livelihoods' incomes. In general, there is scientific and expert consensus that **rainwater harvesting** is an excellent solution to overcome these challenges and make a lasting improvement to resilience and income of the rural population, including risk minimization. Although water harvesting is widely researched from a bio-physical, technical, and, to some extent, socio-economic perspective, its **impact at scale** remains limited, and its adoption is only through projects. This may be explained by the limited research that is done into viable business models and understanding the demand for services or products by the farmers. In other words, an **entrepreneurial spirit** and perspective are needed to achieve the sustainable out-scale of rainwater harvesting interventions, really making an impact at scale. This is what Acacia Water is doing in Jordan within the 3R project funded by the Dutch Embassy in Amman, and what this position is about. To ensure this **cross-cutting** of Sustainable Land Management and entrepreneurship, a unique joint supervision is constructed with the *Education and Learning Sciences (**ELS**)* and *Soil Physics and Land Management* (**SLM**) groups of the WUR, and **Acacia Water**. We believe that this **interdisciplinarity** offers a unique chance for learning and to make societal impact.

The position, which could be a thesis or internship, should mainly look at the integration of interviews with farmers and other stakeholders in land management to understand the needs of potential customers (Value Proposition), possible business models (Business Model Canvas), and rainwater harvesting (e.g., micro vs macro scale, manual vs mechanical). Total period of the position is at least 4 month, of which a certain part can include fieldwork in Jordan. Since the work heavily relies on farmers and stakeholder interviews, Arabic speaking and understanding is a big plus. In addition, since Acacia Water is not permanently present in Jordan but is supported by a local partner, pro-activeness is essential, and earlier knowledge of the country is an advantage.

Project details
Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL or affinity with the topics

Begin date: ASAP
End date: At least 4 months after start

Used skills: Interviewing, fieldwork
Desireables: Arabic speaking or Jordanian national
Requirements: Affinity with rwh, land & water management, business modeling, entrepreneurship

Contact
Supervisor(s):
Karrar Mahdi (WU – SLM)
Yvette Baggen (WU – ELS)
Tine te Winkel (Acacia Water)
Joren Verbist (Acacia Water and WU alumni)
Examiner: Michel Riksen
Contact details:
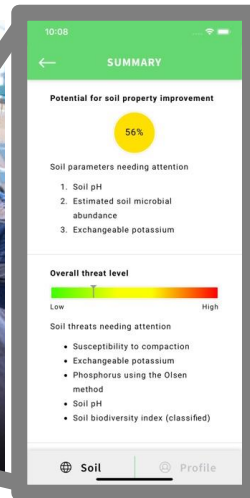Joren.verbist@acaciawater.com and WU supervisors

Bridging the digital divide: supporting the information needs of smallholder farmers

Phito

Country: Europe, Dutch Caribbean

Host institute: Wageningen University or other PHITO project partner

Project description

Problem context

The European Commission has raised the concern that small and medium scale farmers are falling behind in the digital revolution of farming. Large farmers are able to take advantage of opportunities offered by digitalization, e.g. through precision-farming. Small and medium scale farmers face all kinds of barriers in accessing and using digital information. The new PHITO project coordinated by the SLM group will explore such barriers and build a PHITO platform to support the digital information needs of small and medium farmers. As a basis, we have in a previous project developed the SQAPP, a soil quality and soil management information app for land users globally. There are several opportunities on the social and technical side to contribute to the PHITO project through MSc thesis or research practice.

Research Objective

To explore the information needs of specific food system stakeholders, and/or to contribute to the technical development of part of the PHITO platform.

What is expected from the student (type of research)

Variable

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Begin date: Flexible
End date:

Used skills: Various possibilities
Requirements: interest in digital farm support tools

Contact

Supervisor: Luuk Fleskens
Examiner: Coen Ritsema
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MIL thesis opportunities on SLM and PIP-related topics in Uganda

Country: Uganda

Host institute: WUR (SLM)

Project description

Uganda is an exciting country where WENR is implementing the **CommonGround project**, in which both PhD and MSc students from the SLM group can do research. We offer **both physical and socioeconomic related topics** within the CommonGround project, because this project works with the **PIP approach** as its core strategy, and focuses on both **empowering & organizing farmers** for sustainable land management, as well as establishing resilient farming systems with a diversity of **crop and land management practices**.

The CommonGround project works both in the West and East of Uganda, especially in **the highland areas** where land degradation is the main threat, and with smallholder farmers on improving their farming systems, **land management and access to markets**.

Specific research topics are still open and can be discussed depending on the interest of the student, but there are possibilities for both socioeconomic studies (e.g. **impact assessment studies, changes in farmers' motivation and practice**) and physical studies (e.g. **using GIS, assessing land use changes, SWC practices**, etc.).

We are also about to start in other projects in Uganda, so more opportunities will become available in the course of this year.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis research
Begin date: any time
End date:

Requirements: no requirements

Contact

Supervisor(s): Aad Kessler
Examiner:
Contact details: aad.kessler@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

MIL thesis opportunities on SLM and PIP-related topics in **Burundi**

Country: Burundi

Host institute: WUR (SLM)

Project description

Burundi is open (yellow!) for students and offers great opportunities for thesis research!

We offer both physical and socioeconomic related topics within running projects in which SLM and WENR are involved. In Burundi we started about 8 years ago developing the PIP approach, which is now spreading within Burundi and motivating farmers stakeholders to engage in **sustainable land management and erosion control**, so there is a lot investigate.

There are 2 main projects that can host your research:

1. The Fish Farm project in which the **PIP approach** is applied and where we work on **sustainable farming**, tackling land degradation with organized farmer groups and villages, and mapping of **land use changes and degradation process**, also in the upstream watersheds of the fish farms.

2. The PAGRIS project in which farmers apply **integrated farm and soil management practices**, and work in organized groups on sustainable land and **watershed management**, also based on trainings with the PIP approach and with enhanced motivation to invest in their land.

Specific research topics are still open and can be discussed, depending on the interest of the student.

Speaking French (or willing to learn it) is important in Burundi.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis research
Begin date: any time
End date:

Requirements: French speaking or willing to learn French

Contact

Supervisor(s): Aad Kessler
Examiner:
Contact details: aad.kessler@wur.nl